Printed on Thin Paper for Foreign Circulation.

AUG 13 1924

"THE ENGINEER," AUGUST 1, 1924.

BRITISH EMPIRE EXHIBITION NUMBER—No. 15.

# The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXXXVIII.—No. 3579] LONDON: FRIDAY EVENING, AUGUST 1, 1924 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

## PUBLIC NOTICES

TENDERS.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 12th August, 1924, for the SUPPLY of MOTOR LAWN MOWERS. Forms for Tender, &c., may be obtained on application to the CONTROLLER OF SUPPLIES, H.M. Office of Works, &c., King Charles-street, Westminster, London, S.W. 1. 6537

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—

1. TURBO-ALTERNATOR and CONDENSING PLANT for Power-house.
2. BOILER, ECONOMISER, PIPEWORK, &c., for Power-house.
3. 175-K.W., 6600-Volt, Three-phase DIESEL ALTERNATOR SET, with Water-cooling Plant and Pipework.
4. COOLING TOWER for Power-house.
5. 75-K.W. and 38-K.W. CRUDE OIL ENGINE DYNAMO SETS, with Static Balances and Water-cooling Plant.

Tenders due on the 15th August, 1924, for Nos. 1 to 4, and on the 22nd August, 1924, for No. 5. Tender forms obtainable from above. 6539

Assistant Engineers (2) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12, nor more than 18 months' service, with possible extension. Salary, £480 a year for first three years of service, then £510, rising to £720 a year by annual increments of £30, and thereafter to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Free quarters and passages, and liberal leave on full salary. Candidates, aged 25 to 35, preferably unmarried, must have had good general education and be A.M.I.C.E., or hold equivalent qualifications. They must have had proper technical training, and have had not less than two years' subsequent experience on large Engineering or Municipal Works. Preference given to candidates with experience of Waterworks Construction.—Apply at once by letter, stating age, qualifications and experience, also whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting reference M/12,963. 6542

Assistants (Two) REQUIRED by the GOVERNMENT of CEYLON for service in the Architectural Office of the PUBLIC WORKS DEPARTMENT, for a period of three years, with possible permanency. Salary £500, rising by annual increments of £30 to £560 a year, and thence (if appointment is made permanent) to £960 per annum, with efficiency bar at £720, payable locally in rupees at the Government rate of exchange of 15 rupees to the £1. Free passages. Candidates, preferably unmarried, aged 26-30, must have passed examination for Associate Membership of the R.I.B.A. or the Membership of Society of Architects, and have special experience in the actual design and construction of reinforced concrete buildings and of steel-framed buildings. Preferably with war service.

Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/12,945. 6530

Scientific Assistant REQUIRED for Metallurgical Research in an Admiralty Establishment from August. Salary scale £250 by increments of £20 annually to £450, plus Civil Service bonus (which varies with the cost of living and at present amounts to £127 on £250), and benefits under the Federated Universities Superannuation Scheme. Candidates must possess an honours degree or its equivalent and have had research experience.—Replies should be forwarded to the SECRETARY of the ADMIRALTY (C.E.), Whitehall, London, S.W.1, not later than 12th August. 6476

The Government of India REQUIRE the SERVICES of an ASSISTANT CONTROLLER OF INSPECTION for the INDIAN STORES DEPARTMENT.

Three years' agreement in the first instance. Pay at the rate of Rs. 950 per mensem, rising by annual increments of Rs. 50 per mensem to Rs. 1200 per mensem, with certain allowances.

Candidates must be of good general education, should have served an apprenticeship of not less than three years in Engineering Workshops, and possess Drawing-office Experience. They should have obtained five years' practical experience in a responsible position, experience as an Inspector of Engineering Stores being essential. Wide experience in Inspection of Steel Bridgework and Structures is also required. They should have obtained the Associate Membership of a recognised Institution of Engineers or University degree, or possess equivalent qualifications.

Letters of application, stating full particulars of age, education, training and experience, giving dates, with COPIES of testimonials and references, will be received not later than 16th August, 1924, by the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, 42, Grosvenor-gardens, London, S.W. 1, from whom further particulars may be obtained.

August, 1924. 6544

Newcastle-upon-Tyne Education COMMITTEE.

RUTHERFORD TECHNICAL COLLEGE.

Principal: C. L. ECLAIR-HEATH, Wh.Sc., A.M.I.M.E.

APPLICATIONS are INVITED for APPOINTMENT of a LECTURER in MECHANICAL ENGINEERING. Applicants should have had a good technical and scientific education in a University or Technical College, have obtained a degree or its equivalent, and have had good drawing-office and works experience. It is desirable that candidates should have experience in the design and manufacture of internal combustion engines (including Diesel), and possess a good knowledge of hydraulics.

Salary according to Burnham Technical Scale, less 5 per cent.

Applications (on form to be obtained by sending stamped addressed foolscap envelope) to be returned to the undersigned not later than Tuesday, 19th August, 1924.

THOS. WALLING,
Director of Education.

Education Office, Northumberland-road. 6407

## The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Deepening the Inner Harbour at Holyhead.

The British Empire Exhibition (Fifteenth Notice).

The Naval Review.

Electricity Supply in South Africa.

100 Years of British Railways—No. V.

British Wire-Drawing and Wire-Working Machinery—No. III.

The Testing of Thin Metals.

Narrow Gauge Mallet Locomotive for Burma.

The Iron and Steel Industry in Canada.

## PUBLIC NOTICES

UNIVERSITY OF LONDON.

King's College.

FACULTY OF ENGINEERING.

COMPLETE COURSES of STUDY, extending over either three or four years, are arranged in CIVIL, MECHANICAL AND ELECTRICAL ENGINEERING for the Engineering Degrees of the University of London and for the Diploma and Certificate of the College.

The four years' Course provides, in addition to the academic training, opportunity for practical training in "Works."

HEADS OF DEPARTMENTS.

Professor G. COOK, D.Sc., M.I. Mech. E., A.M. Inst. C.E., Mechanical Engineering.
C. A. CORNEVE, B.Sc., A.M.I. Mech. E., Senior Lecturer.
Professor A. H. JAMESON, M.Sc., M. Inst. C.E., Civil Engineering (Dean).
C. H. LOBBAN, B.Sc., A.M. Inst. C.E., Senior Lecturer.
Professor E. WILSON, M. Inst. C.E., M.I.E.E., Electrical Engineering.
F. S. ROBERTSON, M.I.E.E., Lecturer.
Professor S. A. F. WHITE, M.A., Mathematics.
Professor A. E. TOLLIFFE, M.A., ditto.

Considerable extensions have been made in the Engineering Department. These include a large additional drawing-office, lecture room, and laboratory for Hydraulics and Strength of Materials in the Civil and Mechanical Departments; and research rooms, including Wireless Telegraphy, in the Electrical Engineering Department. Large additions have been made to the equipment of the Laboratories in the three Departments for purposes of teaching and research.

There is a College Hostel and a large Athletic Ground.

For full information apply to the SECRETARY, King's College, Strand, W.C. 2. 6531

University of Birmingham.

DEPARTMENT OF METALLURGY.

Professor: THOMAS TURNER, M.Sc., A.R.S.M., F.I.C.
Lecturers and Demonstrators: T. G. BAMFORD, M.Sc.
HAROLD HARRIS, M.Sc.
T. H. TURNER, M.Sc.

The Course of Study covers three years and leads to the Degree of B.Sc. in Metallurgy. There are separate Courses for Metallurgists and Metallurgical Chemists. Special attention is devoted to Iron and Steel, Copper, Brass, and Local Industries, and to preparation for colonial and foreign posts.

Research and other Scholarships.

For particulars apply to the REGISTRAR. 6511

The Coastguards and Fisheries SERVICE of the Egyptian Government are calling for TENDERS for a RIVER MOTOR LAUNCH, length 43ft., beam 7ft. 9in., draft ext. 3ft., fitted petrol or petroleum motor. Tenders will be received at the office of the Coastguards and Fisheries Service, Govenorate Buildings, Alexandria, until Noon, August 31st.—Specifications can be obtained at the office of the INSPECTING ENGINEER, Egyptian and Sudan Governments, Queen Anne's Chambers, Westminster, S.W. 1. 6548

## PUBLIC NOTICES

Borough of Portsmouth.

MAIN DRAINAGE.—CONTRACT NO. 9. TO CONTRACTORS.

The Corporation of Portsmouth is prepared to receive TENDERS for the CONSTRUCTION of REINFORCED CONCRETE DUCT, SUCTION CHAMBER, EXCAVATION for and LAYING of CAST IRON PIPES, LAYING and JOINTING of various lengths of DRAINS, ALTERATIONS to FOUNDATIONS in an existing BEAM ENGINE-HOUSE, and other WORKS at their Eastney Sewage Pumping Station, in accordance with the drawings general conditions and specification prepared by the Engineer, Mr. G. Midgley Taylor, of Messrs. John Taylor and Sons, 36, Victoria-street, Westminster, London, S.W. 1.

The specification, bill of quantities and form of Tender may be obtained from the office of the Engineer upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.

The drawings may be inspected at the offices of the Engineer or at the office of the Borough Engineer, Town Hall, Portsmouth.

Sealed Tenders, endorsed "Main Drainage, Contract No. 9," addressed to the Town Clerk, are to be delivered at his office on or before 9 a.m. on Friday, the 5th day of September, 1924.

The Corporation does not bind itself to accept the lowest or any Tender.

F. J. SPARKS,
Town Clerk.

Town Clerk's Office,
The Town Hall, Portsmouth,
15th July, 1924. 6479

PUBLIC HEALTH ACT, 1875.

Corporation of Marlborough.

EXTENSION OF SEWAGE OUTFALL WORKS.

The Corporation of Marlborough, acting as the Sanitary Authority for the said district, are prepared to receive TENDERS for:—

CONTRACT 2.—CERTAIN ELECTRICAL PUMPING MACHINERY.

CONTRACT 3.—DISTRIBUTORS FOR FILTERS.

Particulars and specifications may be obtained at the Offices of the Consulting Engineers, Messrs. Howard Humphreys and Sons, 28, Victoria-street, Westminster, on and from Wednesday, August 6th, until Saturday, August 16th, between the hours of 10 a.m. and 4 p.m., upon payment of a deposit of One Guinea, which deposit will be returned upon receipt of a bona fide Tender which is not subsequently withdrawn by the contractor.

The successful tenderer will be required to execute a contract deed, the draft of which may be seen at the Offices of the Consulting Engineers when the drawings are inspected.

Tenders must be on the official form, each Tender in a sealed envelope marked "Tender for Contract 2 and/or 3." Tenders must be accompanied by the general conditions and specification as issued by the Consulting Engineers.

Each Tender must be signed in the handwriting of the tenderer or his authorised agent.

The Corporation does not bind itself to accept the lowest or any Tender.

Tenders must reach the undersigned by 9 a.m. on Monday, the 1st of September, 1924.

Given under my hand the 24th day of July, 1924.

E. LL. GWILLIM,
Clerk to the Corporation.

Town Hall, Marlborough, Wiltshire. 6508

The Great Indian Peninsula RAILWAY COMPANY, 48, Copthall-avenue, London, E.C. 2, invite TENDERS for—

1. RAILWAY TICKETS ..... Fee 2s. 6d.

Tenders are due by 11 a.m. on 12th August, 1924. Tender forms obtainable at above address. Fees not returnable. 6551

## PUBLIC NOTICES

Broadstairs and St. Peters URBAN DISTRICT COUNCIL. WATERWORKS.

CONTRACT NO. 1.—PUMPING MACHINERY.

The Council are prepared to receive TENDERS for the PROVISION and ERECTION at their Rumfields Pumping Station of AIRLESS INJECTION COLD STARTING CRUDE OIL ENGINES, Mather and Platt TURBINE PUMPS, and other AUXILIARY PLANT, in accordance with the specification and drawings prepared by the Council's Consulting Engineers, Messrs. H. Rofe and Son, 208, Abbey House, Victoria-street, Westminster, S.W. 1.

The drawings may be seen and a copy of the specification and form of Tender obtained at the offices of the Consulting Engineers upon the payment of the sum of Five Guineas, which will be returned after the receipt of a bona fide Tender.

Tenders to be sent to the undersigned on or before Ten o'clock in the forenoon of Friday, the 15th August, endorsed "Tender for Pumping Machinery."

The Council do not bind themselves to accept the lowest or any Tender.

L. A. SKINNER,
Clerk to the Council.

Pierremont Hall, Broadstairs,
July 31st, 1924. 6519

Metropolitan Water Board. DISPOSAL OF 1000 TONS (APPROX.) OF 75 lb. AND 90 lb. TO 95 lb. F. B. STEEL RAILS.

The Metropolitan Water Board invite TENDERS for the PURCHASE and REMOVAL of Approximately 343 Tons of 90 lb. to 95 lb. and 650 Tons of 75 lb. RAILS, Second-hand and all in good condition, lying stacked at the Board's Littleton Reservoir Works (under construction), near Staines, Middlesex.

These rails may be seen at the above works at any time between 9 a.m. and 4 p.m. (Saturdays excepted), on application to the Board's Contractors, S. Pearson and Son (Contracting Department), Ltd., at their offices at Ashford, Middlesex.

Forms of Tender and conditions of contract may be obtained on and after 30th July, 1924, from the Chief Engineer, Metropolitan Water Board, New River Head, Rosebery-avenue, E.C. 1 (Room 155), by personal application or on receipt of a stamped addressed envelope.

Tenders must be made on the official forms, addressed to "The Clerk, Metropolitan Water Board, 173, Rosebery-avenue, E.C. 1," and endorsed "Tender for Rails, Littleton Reservoir" and delivered to the offices of the Board not later than 11 a.m. on Wednesday, 13th August, 1924.

The Board do not bind themselves to accept the highest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
New River Head,
173, Rosebery-avenue, E.C. 1,
28th July, 1924. 6546

Southborough Urban District COUNCIL. WATER MAIN.

The Southborough Urban District Council invite TENDERS for the PROVISION and LAYING of about 1500 YARDS of 6in. CAST IRON WATER MAIN with CONNECTIONS to the existing distributing mains, with NEW VALVES, HYDRANTS, &c., in accordance with the plans and specification prepared by the Engineers, Messrs. "G. and F. W. Hodson, of Bank Chambers, Loughborough, and London.

Plans and specification may be inspected at the Council Offices, Southborough, and schedules of quantities may be obtained from the Engineers on deposit with them of the sum of £5 5s., which will be returned after the receipt of a bona fide Tender.

Tenders, on the form provided, in sealed envelopes, addressed to the undersigned and endorsed "Tender for Water Main, &c.," must be delivered at the Council Offices, Southborough, on or before Wednesday, the 27th day of August, 1924.

The Council do not bind themselves to accept the lowest or any Tender.

W. N. WOOD,
Clerk to the Council.

Council Offices, Southborough,
29th July, 1924. 6520

Uxbridge Urban District COUNCIL. HOT WATER PLANT.

The Council are prepared to receive TENDERS for the INSTALLATION of a SYSTEM for SUPPLYING HOT WATER to their Slipper Baths, Waterloo-road, Uxbridge.

Particulars to be obtained from the Council's Surveyor, Mr. Wm. L. Eves, 54, High-street, Uxbridge.

Tenders, endorsed "Tender, Baths," to be sent to the undersigned not later than Twelve o'clock Noon on Monday, the 18th day of August, 1924.

No Tender necessarily accepted.

H. M. BLACKWELL,
Clerk.

Council Offices,
109, High-street, Uxbridge,
29th July, 1924. 6536

PUBLIC NOTICES (continued) Page 2.

SITUATIONS OPEN, Page 2.
SITUATIONS WANTED, Page 2.
PATENTS, Page 2.
PARTNERSHIPS, Page 2.
FOR SALE, Pages 2, 3 and 96.
AUCTIONS, Page 96.
PREMISES TO LET OR WANTED Page 96.
WORK WANTED, Page 3.
AGENCIES, Page 2.
MISCELLANEOUS, Page 2.

*For Advertisement Rates see Page 135, Col. 1.*

NUMERICAL INDEX TO ADVERTISEMENTS, Page 95.

## PUBLIC NOTICES

### State Electricity Commission OF VICTORIA, MELBOURNE, VICTORIA, AUSTRALIA.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Morwell Power Scheme.

Copies of Tender form and specification will be available upon application to :—

Agent-General for Victoria,
Melbourne-place,
Strand, London, W.C. 2.

SPECIFICATION NO. 24/68.—22,000-VOLT INSULATORS.

CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract and specification complete. This charge will be returned on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each. This charge is not returnable.

PRELIMINARY DEPOSIT.—A preliminary deposit of £100 is to be lodged with Tender.

The specification may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on the prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m., 20th October, 1924.

E. LIDDELOW,
Secretary.

6545

### Tyne Improvement Commission.

TEN-TON OVERHEAD ELECTRIC TRAVELLING CRANE AT HOWDON YARD.

The Tyne Improvement Commissioners are prepared to receive TENDERS for the DELIVERY and ERECTION of a TEN-TON OVERHEAD ELECTRIC TRAVELLING CRANE at their New Erecting Shop at Howdon-on-Tyne.

Specification and general conditions of contract may be inspected at the offices of the Architects, Messrs. Cackett and Burns Dick, FF.R.I.B.A., Pilgrim House, Pilgrim-street, Newcastle-upon-Tyne, and manufacturers desirous of tendering for the work should forward their names and addresses to them not later than 5th August, 1924, together with a deposit of £2 2s., which amount will be returned upon receipt of a bona fide Tender.

Tenders, in sealed envelopes, endorsed on the cover "Tender for Overhead Electric Travelling Crane," must be addressed to the Chairman, Dredging and River Works Committee, and delivered at the undermentioned offices not later than Noon on 15th August, 1924.

The Commissioners do not bind themselves to accept the lowest or any Tender.

By Order,
ALBERT BLACKLOCK,
Secretary.

Tyne Improvement Commission Offices,
Bewick-street, Newcastle-upon-Tyne,
21st July, 1924. 6477

### Administrative County of LONDON.

The London County Council invites APPLICATIONS from suitably qualified persons for a POSITION of TECHNICAL (ENGINEERING) ASSISTANT on the permanent staff in the Architect's Department. The commencing salary will be £180 a year, rising by annual increments of £15 to £240 a year, with a possibility of promotion. The salary is based on pre-war conditions and is subject to temporary additions on the Civil Service Scale, fluctuating according to the cost of living. The total commencing remuneration is on the present basis £285 15s. 5d. a year. The next revision of the temporary additions will take place not later than 1st September, 1924.

Candidates should be engineering assistants having a sound knowledge of mathematics and practical experience required to check calculations and examine working drawings of steel-frame buildings and reinforced concrete structures.

Members of the Council's staff may apply. Candidates must be under 40 years of age on 9th September, 1924. Due weight will be given to the claims of those who served or attempted to serve in H.M. Forces during the Great War. Candidates who did not so serve in H.M. Armed Forces must be natural-born British subjects.

Apply for forms (containing full details) to the Clerk of the Council, The County Hall, Westminster Bridge, S.E. 1. Stamped addressed foolscap envelope necessary. Forms must be returned not later than 11 a.m. on 9th September, 1924. Canvassing disqualifies.

JAMES BIRD,
Clerk of the London County Council
6517

## SITUATIONS OPEN

AMOS and SMITH, Ltd., Hull, Beg to NOTIFY APPLICANTS that they have now APPOINTED a MANAGER. 6549 A

COUNTY OF LONDON ELECTRIC SUPPLY COMPANY, LIMITED.
BARKING POWER STATION.

The County of London Electric Supply Co., Ltd., THANKS the APPLICANTS for the POSITIONS recently advertised for the Barking Power Station and advises them that the same have now been FILLED. 6547 A

WANTED, RAILWAY MANAGER for Light Railway System (2ft. 6in. gauge) of about 150 miles in India. Must have traffic experience. Age 24 to 30, single. Salary about Rs. 1000 per month. House provided free.

Apply by letter to T. BERNARD HALL and JONES, Consulting Engineers, 115, Colmore-row, Birmingham. 6550 A

WANTED, Thoroughly Competent and Experienced GENERAL MANAGER for Forest Saw Mill and Timber Business in Tasmania. Preferably with knowledge of American methods of timber production. Age 30 to 45.

Also WANTED for same undertaking, LOGGING and RAILWAY ENGINEER with thorough experience of American high lead and overhead methods of log extraction, also railway location and construction. Age 30 to 45. Liberal salaries, free passages, medical examination.—Write full particulars to Box K. A. C., c/o Davies and Co., 95, Bishopsgate, E.C. 2. 6516 A

A LARGE COMPANY of QUARRY OWNERS REQUIRE the SERVICES of a JUNIOR ASSISTANT ENGINEER. Applicants must be from 23-26 years of age and to have had a good general engineering training, preferably on public works ; drawing-office and survey experience absolutely essential. Applicants must state age and give details of training and experience and also state when at liberty to take up duties.—Address, 6512, The Engineer Office. 6512 A

EXPERIENCED and Up-to-date COST ACCOUNTANT REQUIRED ; must be capable of producing accurate costs, fixing departmental charges and proving figures to be reliable on monthly profit and loss statement ; 100 men. State age, wage required, and full details of experience.—Address, P9399, The Engineer Office. P9399 A

FOUNDRY PLANT and EQUIPMENT MAKERS REQUIRE REPRESENTATIVES in Italy ; connection amongst foundries and sound technical knowledge essential.—CONSTRUCTIONAL ENGINEERING CO., Ltd., Charles Henry-street, Birmingham. 6514 A

GRADUATE CIVIL ASSISTANT ENGINEER REQUIRED, Far East, age 25/30 years, specialist structural designing ; preference practical experience Concrete, Wood and Steel Designing and Detailing in architect's office, familiar with building specialities. —Z. J. 145, c/o Deacon's, Leadenhall-street, E.C. 3. 6529 A

INDIA.—WANTED, First-class MAN as MANAGER of RAILWAY WAGON DEPARTMENT of important Engineering Firm. Excellent opportunity for thoroughly capable man.—Write, stating age, with full particulars of training and experience, and copies of testimonials, to Z. W. 177, c/o Deacon's, Leadenhall-street, London. 6540 A

## SITUATIONS OPEN (continued)

MECHANICAL ENGINEER REQUIRED for Service in Africa ; Gas and Steam Engine experience, maintenance small plants, erection steel buildings, able to keep accounts. Tour 30 months, leave six months, housing, medical attendance, free passages. Salary £300 per annum. No sea-going men need apply.—Address applications, stating age, 6527, The Engineer Office. 6527 A

REQUIRED, CIVIL ENGINEER (Young) as Assistant to Resident Engineer for work on all parts of a railway in Central America. Climate tropical. Knowledge of Spanish preferable.—Write full particulars of previous experience, age, &c., with copies of testimonials, to D. D., c/o J. W. Vickers and Co., Ltd., 5, Nicholas-lane, E.C. 4. 6541 A

THE TIBETAN GOVERNMENT REQUIRE an experienced and fully qualified METALLURGICAL CHEMIST, to be stationed at Lhasa, for a three years' contract. Salary £500 to £800 per annum, according to experience. House found and travelling expenses paid both ways.—Written applications to be addressed to E. D. RINGANG, 44, Kenilworth-road, Newcastle-on-Tyne. 6518 A

WORKS ENGINEER, Coventry District.—First-class MAN REQUIRED, to Supervise Design and Construction of Industrial Buildings, Lay-out of Plant and Machinery, and Running of Steam-electric Generating Plant, Electric Motors, and Power Transmission. Apply, letter only, giving full particulars of experience, age, salary required, and reference.—Address, 6481, The Engineer Office. 6481 A

WANTED, ENGINE DESIGNER, Diesel and Semi-Diesel, with good knowledge of latest designs. —Address, stating experience, with references, 6497, The Engineer Office. 6497 A

WANTED for Large Marine Engine Works on the North-East Coast, a thoroughly qualified DRAUGHTSMAN of good education, with experience in Marine Auxiliaries.—Address, stating age, salary required, and giving full particulars of experience and technical training, 6533, The Engineer Office. 6533 A

WANTED for the North Midlands, DRAUGHTSMEN, with experience in Steam Winders design and details, preferably with knowledge of Electric Winders. State age, detailed particulars of experience, and salary required.—Address, 6526, The Engineer Office. 6526 A

WANTED, Good DRAUGHTSMAN for Engineering Works in the Midlands. Must be accustomed to General Engineering. Only first-class men need apply.—Address, 6509, The Engineer Office. 6509 A

WANTED, Good DRAUGHTSMAN, Used to Rolling Mills and Furnaces, and with a good knowledge of Machinery. Apply by letter, stating age, experience, and salary required.—Address, 6455, The Engineer Office. 6455 A

WANTED, STRUCTURAL STEEL WORK DRAUGHTSMAN, thoroughly experienced in designing for and preparing fully detailed shop drawings for Steel Bridge and Roof Work. State age, details of experience, and salary required.—Apply, FRANCIS MORTON and CO., Ltd., Engineers and Contractors, Hamilton Ironworks, Garston, Liverpool. 6459 A

DRAUGHTSMAN WANTED, a Second Charge Hand, Estimating Department ; good experience in the design and calculations of Steel-framed Buildings for home and abroad. Salary £5 10s. weekly.—Address, "DESIGN," Wm. Porteous and Co., Glasgow. P9348 A

DRAUGHTSMAN WANTED, Country District, experienced and accurate in detailing, pumping machinery experience preferable but not essential ; immediate start. State age, salary, and full particulars.—Address, 6552, The Engineer Office. 6552 A

FIRST-CLASS STRUCTURAL DRAUGHTSMEN REQUIRED, for North-East Coast. Must have had experience on Heavy Bridge Work, Foundations, Buildings, &c.; designing, preparing drawings for shops and estimating. State salary required. Others need not apply.—Address, 6305, The Engineer Office. 6305 A

HEAD DRAUGHTSMAN, by Firm Manufacturing High-grade Medium and Small Machine Tools. Preference given to applicant with experience in American precision machinery.—Address, 6465, The Engineer Office. 6465 A

STRUCTURAL ENGINEERS REQUIRE CHIEF DRAUGHTSMAN for their Estimating Department accustomed to control of staff and good organiser ; must be well versed in modern design of Light Steel-framed Buildings. State experience, salary required.—Address, "STRUCTURAL," Wm. Porteous and Co., Advertising Agents, Glasgow. P9347 A

## SITUATIONS WANTED

ACCOUNTANT (25), A.I.S.A., F.B.I., 5 Years' Experience in charge engineers' and chemists' office, SEEKS congenial POST. Highest refs.—BAKER, 58, Monmouth-street, Bridgwater, Som. P9396 B

ADVERTISER (40), Skilled Mechanic, SEEKS SITUATION ; life experience, good all-round man, experimental, light mechanical work, electrical experience, excellent references ; London district preferred.—Address, P9400, The Engineer Office. P9400 B

A.M.I.C.E. (33), Railway Locomotive Works and D.O. trained, 5½ years district locomotive superintendent, automobile, hydraulic, maintenance and general engineering experience, also commercial, used to control of large staffs, DESIRES progressive POST where initiative and varied experience are needed. Moderate salary to commence.—Address, P9373, The Engineer Office. P9373 B

## CHINA.

COMMERCIAL ENGINEER of Wide Experience, 40, technically and practically trained, recently with leading merchant firm China, DESIRES to REPRESENT one or more MANUFACTURERS, China, or secure other suitable position, home or abroad. Will be glad discuss prospects China market without obligation.—Address, P9391, The Engineer Office. P9391 B

CIVIL ENGINEER (30) SEEKS POSITION, Here or abroad ; 8 years' experience in erecting dams, hydro-electr. power stations, piling plants, &c.; thorough knowledge of German. Mod. sal. reqd.—Address, P9386, The Engineer Office. P9386 B

CONSULTING ENGINEER and MARINE SURVEYOR, age 28, DESIRES POST in similar capacity as Assistant ; 1st Class B.O.T. Certificate, 5 years' drawing-office experience. Good knowledge of ship repairs and estimating. Moderate salary required.—Address, P9392, The Engineer Office. P9392 B

GENTLEMAN, Age 31, with a Capacity for Hard work, DESIRES to REPRESENT a well-known ENGINEERING FIRM. Willing to demonstrate his energy and initiative with a view to an ultimate position of responsibility at home or abroad. Has general practical knowledge mechanical engineering, drawing-office and works, also commercial experience. Excellent references.—Address, P9389, The Engineer Office. P9389 B

MARINE ENGINEER (30), First Class B.O.T. Certificate, 16 years' sea experience, 12 months chief semi-Diesel engines, 9 months large Diesel erecting shop, DESIRES SITUATION ; shore berth preferred, home or abroad. Ex. refs.—Address, P9401, The Engineer Office. P9401 B

MECHANICAL ENGINEER, Age 34, at Present machine shop foreman in large works in Africa, DESIRES similar POST or ASSIST. WORKS MANAGER, preferably in England ; 7 years' experience estimating and rate fixing. Good all-round engineering experience ; well up in up-to-date methods of production and control of labour. Good references. —Address, P9394, The Engineer Office. P9394 B

## SITUATIONS WANTED (continued)

YOUNG CIVIL ENGINEER, University, Articles, and engagement with large Port Authority, awaiting result of B.Sc. (Lond.) Exam., DESIRES CHANGE with good experience, at home or abroad. Experienced in steel and R.C. design and supervision, warehousing and wharves, canal, river and harbour work, all classes of surveying. Excellent references.
Address, P9387, The Engineer Office. P9387 B

BOILERMAKER (37) DESIRES POST at Home or abroad. Twenty years' experience on boilers, marine, loco., vertical, &c.; constructional and general engineering. Eight years' experience in India, Persia, and Central America on oilfields and railway works. Excellent references.—Address, P9395, The Engineer Office. P9395 B

## PARTNERSHIPS

IF YOU ARE SEEKING
A PARTNER or PARTNERSHIP
or wish to buy or sell a
BUSINESS or WORKS
Write :
WHEATLEY KIRK, PRICE & CO.,
46, Watling Street,
London, E.C. 4.
Established over 70 years.

ELECTRICAL ENGINEERING. — Old-established Manufacturing Business. Good salaried position to investor about £5000. Debenture security.—Address, P9397, The Engineer Office. P9397 C

PARTNERSHIPS and ACTIVE DIRECTORSHIPS WANTED in Mechanical, Constructional, Electrical Engineers, &c., for Clients with technical experience and capital from £1000 to £20,000.—GILBERT and PRATT, 18, Walbrook, London, E.C. 4. Ex C

## EDUCATIONAL

A.M.I.C.E., A.M.I.M.E., B.Sc., AND ALL ENGINEERING EXAMINATIONS.—All my students have my personal attention. Thousands of successes during the past nineteen years. Courses can be commenced at any time. Please note change of address.—G. P. KNOWLES, M.I.E., B.Sc., A.M.I.C.E., &c., Parliament Mansions, Victoria-street, Westminster, S.W. 1. Ex. B

CORRESPONDENCE COURSES for Inst. C.E., Inst. Mech. E., London Univ. (Matric., Inter., and B.Sc.), personally conducted by Mr. TREVOR W. PHILLIPS, B.Sc. (Honours), Assoc. M. Inst. C.E., M.R.S.I., F.R.S.A., &c. Also Day Tuition in Office. Excellent results at all Exams. Courses may commence at any time.—8/11, Trafford Chambers, 58, South John-street, LIVERPOOL. Ex. B

SURVEYING AND LEVELLING. — EXCELLENT OPPORTUNITY to ACQUIRE thorough practical INSTRUCTION on WORK. — Address, E. MOUL, Hollybank, Woking. P9332 B

TUITION BY POST.—Inst. C.E. and I. Mech. E. Enrol now for next Exams.; 100 per cent. passes last examination. Reinforced Concrete, new comprehensive course under expert engineer, £3 3s. Write for particulars.—PENNINGTONS, University Tutors, 254, Oxford-road, Manchester. Estab. 1876 Ex.

## AGENCIES

STEEL AND MALLEABLE CASTINGS.—ADVERTISERS, at present representing grey iron and aluminium castings and with good selling organisation, DESIRE to REPRESENT first-class STEEL FOUNDERS, also MALLEABLE FOUNDERS. Districts worked London and South, Midlands, Lancashire and Yorkshire, and Eastern Counties.—Address, 6433, The Engineer Office. 6433 D

## MISCELLANEOUS

ADVERTISERS are BUYERS All Quantities Used RAPE OIL. Please quote and advise quantities available.—Address, 6302, The Engineer Office. 6302 I

ENGINEERING FIRM REQUIRED, Capable of Cutting Tread Patterns in Cast Steel Tyre Moulds of large diameters ; must produce high-class job within fine limits ; quick deliveries required. Give full particulars.—Address, 6532, The Engineer Office. 6532 I

THE PROPRIETORS of a UNIQUE PROCESS of REFRIGERATION of very simple construction, adaptable for all purposes and eliminating entirely all valves, cocks or moving parts in connection with the refrigerant, are DESIROUS of meeting with a firm or financial partners to find CAPITAL to EXPLOIT or PURCHASE same on reasonable terms.—Address, P9381, The Engineer Office. P9381 I

## PATENTS

INJECTOR MECHANISM.—BRITISH PATENT No. 121,971, dated 16th September, 1916.—The OWNERS of the PATENT DESIRE to DISPOSE of the same either by SALE outright or the GRANT of a LICENCE, and particulars may be obtained from TECHNICAL RECORDS, Limited, 59 and 60, Lincoln's Inn-fields, London, W.C. 2. 6524 H

THE PROPRIETORS of the BRITISH PATENT No. 172,174, relating to "Multi-stage Centrifugal Pumps," are PREPARED to ACCEPT TENDERS for the MANUFACTURE of the PUMPS in Great Britain or to consider APPLICATIONS for the GRANT of LICENCES or the DISPOSAL by PURCHASE of their rights.—Applications in the first instance should be addressed to KILBURN and STRODE, 31, High Holborn, London, W.C. 1. P9388 H

THE PROPRIETOR of BRITISH PATENT No. 20,406/09, dated September 6, 1909, relating to "Hairpin Holders," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 6528 H

THE PROPRIETOR of LETTERS PATENT No. 157,042, relating to
"COKE QUENCHING DEVICE,"
DESIRES to DISPOSE of his PATENT or to GRANT LICENCES to interested parties on reasonable terms for the purpose of EXPLOITING the same and ensuring its full commercial development and practical working in this country.
Enquiries to be addressed to CRUIKSHANK and FAIRWEATHER, 65-66, Chancery-lane, London, W.C. 2. 6543 H

## FOR HIRE

FOR HIRE, PUMPS and WELL-BORING TOOLS for Contractors' Deep Wells, &c., 2in. to 24in. dia.—E. RICHARDS and CO., Upper Ground-street, London, S.E. Telephone No. 978 Hop. 822 K

FOR SALE or HIRE, ELECTRIC MOTORS, from ½ 60 to 300 H.P.; PORTABLE STEAM ENGINES, from 8 to 40 N.H.P.; STEAM BOILERS, CRANES, PUMPS, MACHINE TOOLS of every description ; reasonable terms, immediate delivery.—J. T. WILLIAMS and SONS, 37, Queen Victoria-street, London, E.C. Tel., City 3956. Ex.

## FOR SALE

### ALFRED HERBERT, LTD.

'Phone : COVENTRY. Wires :
860 (3 lines). Lathe, Coventry.

### SURPLUS MACHINES.

Your are cordially invited to inspect the large stocks of NEW, RE-CONDITIONED, and SECOND-HAND MACHINES which we are offering at specially REDUCED PRICES from our Coventry warehouses. The following is a selection :—

#### AUTOMATIC MACHINES.

1in. by 5in. New Britain Six-spindle Automatic (RE-CONDITIONED).

5-8in., 7-8in., 1¼in. Cleveland Model "A" Automatics (RE-CONDITIONED).

No. 6 Alfred Herbert Auto. Lathes, S.S. feeds, 19in. swing, 10in. stroke of capstan (RE-CONDITIONED).

#### BORING MACHINES.

60in. Gisholt Vertical Boring Mill, two swivel heads, power traverse (SECOND-HAND).

2½in. Dickinson Horiz. Boring, Drilling, Tapper and Milling Machines, S.P. gear-box drive with swivel table (RE-CONDITIONED).

40in. Webster and Bennett Duplex Boring Mill, two 30in. tables and belt drive (SECOND-HAND).

#### DRILLING MACHINES.

Alfred Herbert Single-spindle B.B. Drill, with automatic feed, pump and fittings (RE-CONDITIONED).

6ft. McKendrick Girder Type Radial Drill, with single-speed motor drive, but minus motor (NEW).

28in. American Tool Works Sliding Head Upright Drill, C.P. drive, auto. feed, with two-speed S.C. countershaft and 18in. by 48in. rectangular table (SECOND-HAND).

#### GRINDING MACHINES.

10in. by 17in. Cincinnati Universal Tool and Cutter Grinder, belt drive and standard equipment (RE-CONDITIONED).

3in. by 16in. Norton Plain Cylindrical Grinder, S.C. belt drive (SECOND-HAND).

6in. by 32in. Ditto Ditto Grinders, overhead belt drive and countershaft (SECOND-HAND).

#### LATHES (CENTRE).

9in. by 8ft. American Tool Works S.S. and S.C. Lathe, C.P., D.B.G., quick change, complete with countershaft, compound tool rest, steady rest, 18in. face-plate, pump and fittings, 1¼in. through spindle, 4ft. 9in. between centres (RE-CONDITIONED).

9in. by 10ft. Lodge and Shipley S.S. and S.C. Lathes, C.P., B.G., quick change, 1 3-8in. through spindle 6ft. 1in. between centres (RE-CONDITIONED).

9in. by 18in. by 16ft. Putnam Extension Bed Gap Lathe, C.P., Q.C., gap closed 6ft., gap open 9ft. 8in. (RE-CONDITIONED).

#### MISCELLANEOUS.

No. 1 Richards Slot Drill and Keyway Cutter, belt drive, automatic feed and stop for regulating depth of cut, countershaft and spanners (RE-CONDITIONED).

No. 2 Brown and Sharpe Automatic Screw Machine, with two friction clutch pulley drive, 6-hole round turret, pump and fittings (SECOND-HAND).

No. 2 Garvin Horiz. Tapper, with 4in. chuck and countershaft, cap. 3-16in. to 4in. (NEW).

6527 G

A SPLENDID SELECTION of 60 NEW and PERFECT 3in. PARALLEL SLIDE VALVES, all G.M. outside screws, turned and faced ; 1s. 7d. per lb. Special terms to stockists.—H. JONES, King-street Warehouses, Bury. 6439 G

BOILERS.

| | | | |
|---|---|---|---|
| Two Lancs. | 30ft. | by 8ft. 6in., | 160 lb. |
| Three ,, | 30ft. | by 8ft. 0in., | 145 lb. |
| Three ,, | 22ft. | by 8ft. 6in., | 120 lb. |
| Four Cochran | 14ft | by 8ft. 6in., | 160 lb. |
| One ,, | 8ft. | by 4ft. 6in., | 160 lb. |
| One ,, | 8ft. | by 3ft. 0in., | 100 lb. |
| One Vertical | 9ft. | 6in. by 4ft. 6in., | 100 lb. |
| One ,, | 7ft. | 6in. by 2ft. 6in., | 100 lb. |
| One ,, | 9ft. | 6in. by 4ft. 6in., | 100 lb. |
| One Loco. Type Boiler and Engine | 9ft. | 6in. by 2ft. 6in., | 80 lb. |

W. KAYLEY,
Queen-street Ironworks,
Chancery-lane, Ashton Old-road,
Ardwick, Manchester.
Tel. Nos.: 1058 Central, 8397 City. 6224 G

DIESEL ENGINES, 300, 530, 800, 1200, and 1750 B.H.P.; M.A.N., with or without dynamos, condition as new, about one-third market price; seen London. All spares for above sizes in stock.—HICK DIESEL OIL ENGINES, Ltd., 70, Queen-street, E.C. 4. 6200 G

FOR IMMEDIATE DISPOSAL, 120,000 Gallons Per hour HORIZONTAL TRIPLE-EXPANSION SURFACE-CONDENSING WORTHINGTON PUMPING ENGINE with DUPLEX DOUBLE-ACTING WELL PUMPS and DUPLEX DOUBLE-ACTING HIGH-LIFT PUMPS, not erected, as purchasing firm do not require delivery for 12 months. Can be inspected at Worthington-Simpson's Works, Newark.—Address, 6409, The Engineer Office. 6409 G

FOR SALE, LANCASHIRE BOILERS, Re-lissues 100 lb., all fittings, one or 2 at £150 each.

Willans ENCLOSED COMPOUND, about 12 and 8in. double cylinders, vertical extended bed for direct drive ; £100.

Aveling's 12in. by 14in. HORIZONTAL ; £70.

PNEUMATIC RIVETERS and ROTATING ; half price.

FRANK W. ALLCHIN, Tannery, Sittingbourne. 6538 G

FOR SALE, Nearly New COCHRAN BOILER, 16ft. 6in. by 8ft., new 1923, 160 lb. pressure, with chimney 40ft. by 2ft. 6in.—GEO. COHEN SONS and CO., Ltd., 600, Commercial-road, E. 14, London. 6440 G

FOR SALE, ONE Excellent HORIZONTAL COMPOUND CONDENSING STEAM ENGINE, 200 H.P., by Gimson, Stalybridge, in perfect order.—Can be seen running any time by appointment at R. RADCLIFFE and SONS (Mossley), Ltd., Squire Mill, Mossley, Lancs. 6513 G

FOR SALE, ONE 3000 K.W. TURBO-ALTERNATOR, 2200/2400 v., periodicity 100, 3000 revs., steam 160 lb., with Condenser, &c.—Address, 6231, The Engineer Office. 6231 G

FOR SALE, Splendid Robey SEMI-PORTABLE OVERTYPE COMPOUND ENGINE and BOILER, indicates 200 H.P., cylinders 12in. and 21in. by 18in. stroke, boiler insured 160 lb. original pressure, fitted superheater and pumps. Only in use 15 months, equal to new. Will accept low price, immediate clearance ; present day price over £2000.—GEO. COHEN SONS and CO., Ltd., 600, Commercial-road, E. 14, London. 6437 G

**For continuation of For Sale Advertisements see page 3.**

# A Seven-Day Journal

## Safety at Sea.

DURING last week sub-committees of the League of Nations Committee on Communications and Transit met jointly at the London Chamber of Commerce and discussed questions of safety at sea and the protection of navigation. Members and experts from Great Britain, France, Italy, Japan, Belgium, Spain, Germany, Norway, Uruguay and Cuba attended the meetings. The Titanic Convention of 1914 is held to be in need of revision, while many problems pertaining to the protection of navigation have never been made the subject of any form of international convention. Among the subjects discussed at last week's meeting were the organisation of salvage, the standardisation of buoys, the unification of marine charts, wireless matters affecting safety at sea, double taxation as it affects maritime navigation, the unification of methods of measuring the tonnage of vessels, and the revision of sanitary conventions. The sub-committees in discussing these matters took into consideration the resolutions adopted at the recent international shipping conference, and appointed several bodies of experts to collaborate with certain existing organisations already studying some of the subjects under notice. The meeting finally decided to appeal to the Governments represented to expedite the signature of the Convention on Maritime Ports adopted at Geneva in December last year. It was held that the adoption of that convention is essential if international navigation is to be facilitated.

## The Gretna Sale.

THE public sale of the land, buildings and plant at the Government's explosives factory at Gretna came to an end last Friday, with the result that much of the property still remains in the Government's hands. The sales effected were principally for land. Very modest figures were offered and accepted—the total sum realised was barely £82,500—but when the ether distillery, a section of the undertaking said to have cost a quarter of a million to build and covering some 60 acres, was put up and failed to secure an offer in excess of £18,500, it was apparently decided that the proceedings had gone far enough. Although the Government was willing to let this plant go for a moderate figure in the hope that a private manufacturer would buy it for the purpose of making alcohol or ether, it was withdrawn from sale at the figure stated. The fate of some other war time or post-war time activities of the Government has also been revealed within the last few days. During the war a large number of 2–8–0 superheater tender locomotives of a standard Great Central type were built in this country for moving troops and materials. Those lent to the British railways were subsequently returned to the Government after an average service of about eighteen months. Quite recently 125 of these engines were sold to the London and North-Eastern Railway for handling heavy goods and coal traffic, and others have been purchased by a Dominion railway.

## The Woolwich Locomotives.

IMMEDIATELY after the war, in order to minimise the effect of the sudden cessation of armament work at Woolwich the Government sanctioned the construction of one hundred locomotives at the Arsenal. The engines were of the 2–6–0 type, and were designed by Mr. Maunsell, of the South-Eastern. They were of a standard mixed traffic type, and were fitted with Belpaire boilers to the specification of the North British Locomotive Company, of Glasgow, and Messrs. Stephenson, of Darlington. Fifty of the locomotives were completed—at, it may be remarked, a high cost—and the parts for the remainder had been manufactured when a change of policy lead to further construction being abandoned. Twelve sets of parts were acquired by an Irish railway for the purpose of building some broad gauge engines, and six sets are now being used in building some 2–6–4 tank engines for the Metropolitan Railway at the works of Armstrong, Whitworth and Co., Newcastle. Certain modifications and constructional alterations are being made in the parts, but the finished engines, it is stated, will embody the salient features of the Southern Railway's 2–6–0 type of mixed traffic engine.

## French Monopolies.

MONOPOLIES die hard when they depend upon a principle which a large section of the community regards as the basis of a national economic policy. The match monopoly in France was definitely suppressed by the last Government on the ground that a far larger revenue could be obtained from a tax on matches manufactured by private firms than from their manufacture by the State. The new Socialist Government has now succeeded in restoring the monopoly, and meets the objection that the State is wasteful and incompetent as a producer by proposing to create an independent and autonomous department under the control of a board of directors composed of business men. New factories would be established equipped with the most modern plant. In this way the Socialists hope to preserve the principle of State monopolies. They are not sure of succeeding, any more than they can hope to preserve the alcohol monopoly which is the only other one remaining. This monopoly has for some time past proved extremely troublesome to the various Governments that have been in power. While the idea was to control the alcohol production so as to ensure adequate supplies in time of national danger, the methods adopted have proved disastrous for the country's finances, and have actually had the effect of diminishing supplies, creating trouble with beet growers, and reducing the quantity of beet available for the sugar factories. The attempt to create a national fuel with alcohol has failed completely, and a strong movement is growing in favour of the abolition of the alcohol monopoly.

## Hydro-Electric Exhibition.

As soon as M. Herriot returns to France he will lay the foundation stone of the exhibition buildings which are to be constructed at Grenoble, for what will probably be one of the most important manifestations of hydro-electric activity yet held. Some of the most important and interesting installations are in the department of the Isère, and Grenoble itself has become one of the leading centres of research in this field of power distribution. The exhibition will be one of the most complete of its kind. Meetings are to be organised dealing with electricity in all its phases, and special attention will be given to electric road traction, which it is hoped will develop considerably in rural districts as the result of the distribution of cheap current and the facilities provided for recharging batteries all over the country. Electric omnibuses will be employed for the public services in connection with the Grenoble Exhibition.

## Foreign Warship Refits.

ACCORDING to a despatch from Buenos Ayres, the Argentine battleship Rivadavia will sail for Boston, Mass., early this month (August) to undergo an extensive refit. She will be followed in a few months' time by her sister vessel, the Moreno, which is also to be thoroughly reconditioned. The work is apparently to be done in the Government dockyard at Boston. It has been known for some time that the Argentine authorities had in view the modernisation of certain naval units, and there were hopes that British firms would secure a share of the work, which would have been uncommonly welcome in view of the stagnation which now prevails in the shipbuilding industry here. The two battleships in question are the largest and most powerful units of the Argentine Navy, displacing nearly 28,000 tons apiece. They were laid down in 1910 by the Fore River Company and the New York Shipbuilding Company respectively, and delivered nearly five years later. There was keen competition for the contracts, for which several British and German firms were invited to tender, and it is understood that the final award was not governed solely by considerations of finance. Besides having their armament and other equipment brought up to date, the ships are to be fitted with oil-fired boilers. The cost of the work is expected to exceed a million sterling. Shortly after the war two Brazilian battleships, the Minas Geraes and Sao Paulo, were reconditioned at New York at a cost of more than two millions. Contracts for the reconstruction of the Brazilian cruisers Bahia and Rio Grande do Sul are believed to be impending, and there is still some hope that the order will find its way to this country.

## New Wiring Rules.

NEW regulations governing the electrical equipment of buildings have just been issued by the Institution of Electrical Engineers. Mr. C. H. Wordingham is the chairman of the Wiring Rules Committee, but on account of his recent illness, from which we are glad to hear he is now recovering, Mr. Ll. B. Atkinson has had to pilot the rules through their last stages. Owing to the differences in opinion of the various interested parties the compilation of the new rules presented great difficulty, and it was not until Mr. Atkinson adopted the plan of settling the various clauses on the basis of votes that the rules began to assume their present form. Although we do not suppose that the new regulations will meet with the approval of everyone connected with the electrical industry, it is worthy of note that no fewer than 500 bodies have accepted them. The problem of earthing seems to have given rise to much thought and discussion, and although certain rules have been laid down it is open to any responsible person to put forward alternative schemes to meet special requirements. Subject to certain specified conditions, a fuse may now be placed in an intermediate adapter designed for insertion in a wall socket. The types of cables that may be used are specified, but the rules do not in any way prevent the introduction of new and reliable cables that can be shown to be advantageous. A section of the book well worthy of study is that devoted to the identification of cables by colours, and a fact called attention to, which is perhaps none too well known, is that the standard colours adopted for the identification of switchboard connections are not the same as those which are adopted on other circuits.

## American Shipbuilding.

THREE weeks ago we referred in the Journal to the United States Shipping Board's decision to recondition and convert twelve single-screw steamships to oil engine propelled vessels. The Chairman of the Board, Mr. T. V. O'Connor, has recently announced the decision of the Advisory Committee which was appointed to recommend the most suitable type of marine oil engine for propulsive purposes. The Committee unanimously agreed, we understand, to recommend that only slow-speed engines of well-proved types, directly connected to the propeller, should be installed. While recommending such engines for the initial twelve ships, the Committee pointed out the desirability of encouraging the development of the double-acting oil engine, and engines of this type will receive consideration when the conversion of further ships is undertaken. Another interesting American shipbuilding development is the construction of a passenger liner for service between San Francisco and Honolulu, which, when completed, will be the largest and fastest ship yet built in the United States. This vessel has been ordered by the Matson Navigation Company and will be built at the Delaware yards of William Cramp and Sons, Philadelphia. The design provides, we understand, for a length of 578ft. with a breadth of 76ft. Accommodation will be given for over 600 first-class passengers and refrigerated cargo space for fruit carrying is to be provided. The propelling machinery is to be of the twin-screw turbo-electric type, and steam will be raised in a battery of oil-fired water-tube boilers. The main motors are to be designed for a total output of 21,000 shaft horse-power, which allows for a service speed of 21 knots with a reserve of power. The auxiliary machinery is to be as far as possible electrically driven. The ship, which has been projected for some years, will be completed according to the contract within two years, and if successful will most likely be followed by sister ships operating on the same route.

## Fighting Coastal Erosion.

A CONFERENCE of members of Parliament and representatives of county councils and local bodies, convened by the Lowestoft Town Council, was held at Caxton Hall, Westminster, on Friday last, to consider the question of coastal erosion and to discuss the possibility of taking steps to urge upon the Government the necessity of making the cost of sea defence work a national charge. The chair was taken by Mr. Gervais Rentoul, member of Parliament for Lowestoft, who reminded the conference of the severe burden which Lowestoft had been called upon to bear in connection with its sea defence work. He referred to the report of the Royal Commission on Coast Erosion issued in 1911, and pointed out that its findings were diametrically opposed to the contention which the conference sought to uphold and to urge upon the Government. The findings of the Commission, he said, were based upon three main points: first, that there was no legal obligation on the Crown for sea defence; secondly, that sea defence was not a national service; and thirdly, that the principle of State grants was undesirable. The report did, however, emphasise the need for central governmental control, which was undoubtedly in the national interest. Mr. E. G. Pretyman, of the East Suffolk County Council, suggested that local natural conditions should be carefully studied with a view to making the sea defeat itself. Any universal interference by engineers with special schemes of sea defence was, he argued, absolutely fatal and would result in enormous expenditure. A resolution was passed by the conference declaring that the cost of sea defence works constituted an intolerable burden upon many areas affected by coast erosion, and severely handicapped the progressive development of such areas. The resolution asked that the cost of such works should no longer be wholly borne by the coastal towns, but that the Government should make adequate contribution towards such schemes. The views of the conference will be put before the Prime Minister through a deputation.

## Standardised Steel Houses.

WHEN addressing the students of the Architectural Association's School of Architecture in London on the occasion of the annual prize-giving and inspection of work on Friday last week, Mr. Winston Churchill emphasised the need of novelty and of new methods of construction if the difficulties which beset the housing problem were to be overcome. Within the last few days, he said, he had seen some models of steel cottages, which were to be built from manufactured units composed of stamped steel sheets and frames. The steel shell of the house would be backed with a timber lining, leaving an intermediate air space. He was assured that such houses would meet all the requirements of the Ministry of Health, and furthermore, that they could be rapidly constructed at a cost far below that required for similar houses built on the usual lines.

# The British Empire Exhibition.

## ENGINEERING EXHIBITS. No. XV.*

### GENERAL ENGINEERING EXHIBITS.

#### Culley Expressors, Limited.

On the stand of Culley Expressors, Limited, 46, Leadenhall-street, London, E.C., the sole licensees for the Culley oil-machinery patents, there is a highly interesting exhibit, as the firm claims to be the only one which can supply an efficient palm fruit depericarping machine that enables the ideal "dry" process for the manufacture of palm oil to be carried out.

Many attempts have been made to treat palm fruit in a scientific manner without causing the oil to decompose and form fatty acids, thus lowering the glycerine content and consequently the monetary value. The "wet" process which is commonly used generally calls for the use of large quantities of water, or steam under pressure, both of which have the almost inevitable result of inducing hydrolysis in the oil, changing it from a neutral into an acid condition by the breaking down of its constituents into free glycerine and free fatty acids. The free glycerine is washed away and lost, and unfortunately hydrolysis once having started, continues, so that the oil becomes what is known as "semi-hard" or "hard," and its commercial value is proportionately reduced as compared with "soft" oil.

The great difficulty hitherto has been in separating the oily pericarp—or outer fibre covering—from the nuts. It is quite easy to loosen the pericarp by simply stirring a mass of fruit, causing it to rub on itself and thus loosen the fibre, but when separation by screening is attempted it is found to be impossible owing to the oily nature of the fibre, and the great variation in size and shape of the nuts. Some makers put this mass of oil, fibre and nuts, after subjecting the fruit to stirring under steam pressure, through a centrifugal machine, obtaining a quanity of oil as a result; but Culley Expressors, Limited, claims that it is impossible to obtain as much oil by this method as can be done by treating the fibre and oil alone.

The process that the firm advocates for the manufacture of "soft" palm oil by the "dry" process on a large scale is as follows:—The palm fruit is collected and brought to the factory by the natives, and at the earliest possible moment after receipt is heated in a steam-jacketed steriliser, without the use of raw steam or stirrers, for a certain period of time. From the steriliser the fruit is fed by means of an elevator to the hopper of the depericarping machine—Fig. 287—which delivers the cleaned nuts from a shute at the side, the pericarp dropping on to a band conveyor forming part of the machine. This conveyor delivers the pericarp into a draining tank with removable strainers—Fig. 288—which in their turn are emptied into a steam turbine-driven centifugal—Figs. 290 and 291—the exhaust steam being used to keep the revolving basket hot, and thus facilitate the flow of oil. The great advantage claimed for this type of machine is that it can be started very slowly, enabling the main flow of oil to come away without matting the fibre and thus causing choking at the beginning, the result being the recovery of an increased percentage of oil. Alternatively, the fibre as delivered from the depericarping machine may be reheated and then put through hydraulic presses in the ordinary manner.

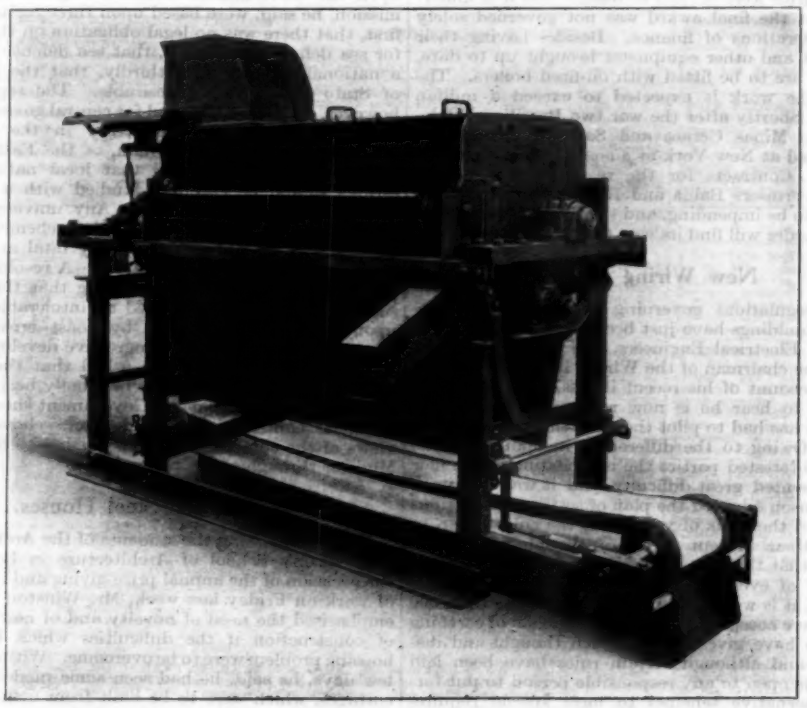


FIG. 287—DEPERICARPING MACHINE—CULLEY EXPRESSORS

The power type of depericarper—Fig. 287—contains a barrel composed of a number of sheet steel discs—Fig. 289—with a stabbed periphery, formed into a long helix. Mounted between these discs are agitators for constantly disturbing the fruit in its passage through the machine. Along the top portion of the barrel, and concentric with the shaft are longitudinal passages into which the fruit is dropped at one end by means of an adjustable self-acting feed. In its movement along these passages the fruit is gently rasped by the discs to remove the fibre, and at the same time the agitators keep turning it over so that each fruit is continually presenting a fresh facet towards the rasping surface. There are small spaces between the edges of the top chambers and the drum, which are just sufficient to allow the

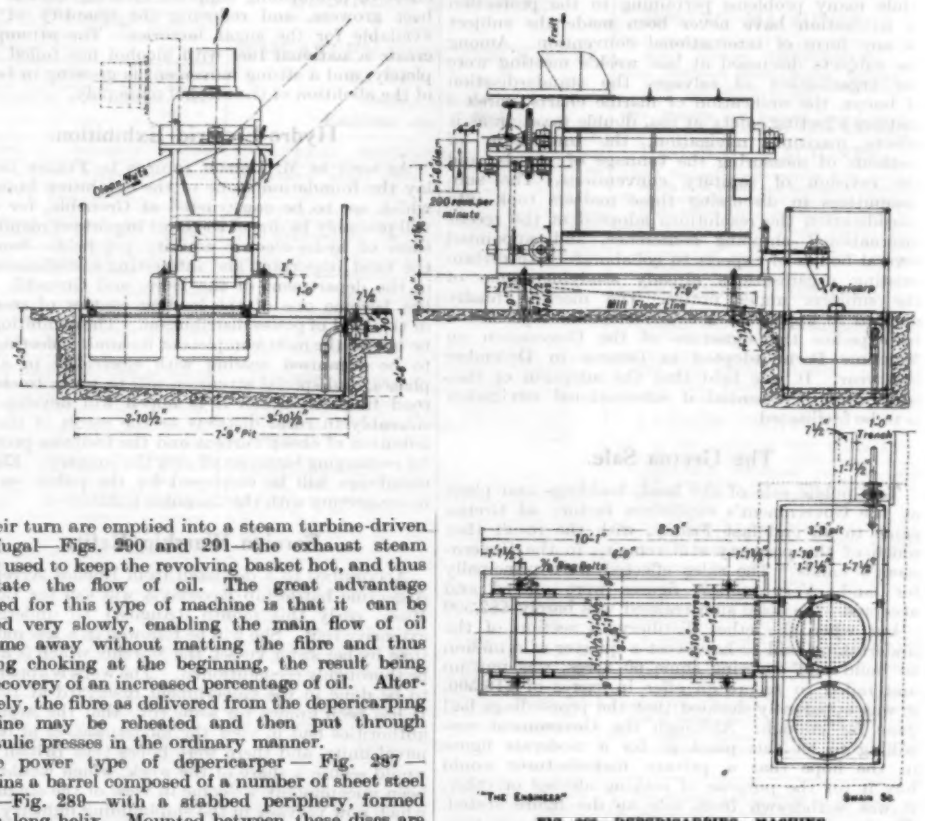



FIG. 288 DEPERICARPING MACHINE

flexible agitators and the pericarp to pass and yet retain the smallest nut without cracking it. The agitators are arranged in the form of a screw along the periphery of the barrel, and have the additional function of gently urging the nuts towards the delivery end of the barrel, whence they drop in a cleaned state through a shute at the side of the machine. The pericarp is brushed from the periphery of the barrel by a revolving wire brush which overruns the barrel, and throws the fibre on to the band conveyor underneath. The top chamber is arranged to hinge, so that when required the barrel may be changed in a few minutes and the machine restarted.

FIG. 289—DISC OF DEPERICARPER

The machine weighs about 25 cwt. complete, takes about 2 horse-power to drive, will depericarp 10 cwt. of fruit per hour, and is constructed practically throughout of steel so as to resist rough handling

* No. XIV. appeared July 25th, 1924.

during shipment, and to reduce carriage charges to a minimum. The firm also shows a hand-power depericarping machine—Fig. 292—built on the same principle but without the revolving brush or power feed. One person works it with one hand, feeding the fruit in with the other, and as it only weighs 2¼ cwt. it is easily portable. A wire brush is supplied with each machine of this description for cleaning the barrel as required. There is also shown a small hand-power screw press—Fig. 293—to be used in conjunction with the hand-power depericarper. It is made from steel castings, and has a removable perforated steel box, the whole weighing under 1½ cwt. We understand that these hand machines have already found considerable favour, as by their use the native is enabled to produce a much larger quantity of oil of superior quality from the same amount of fruit than he can by the ordinary method. A nut-cracking machine is also shown, which, we are informed, is in extensive use.

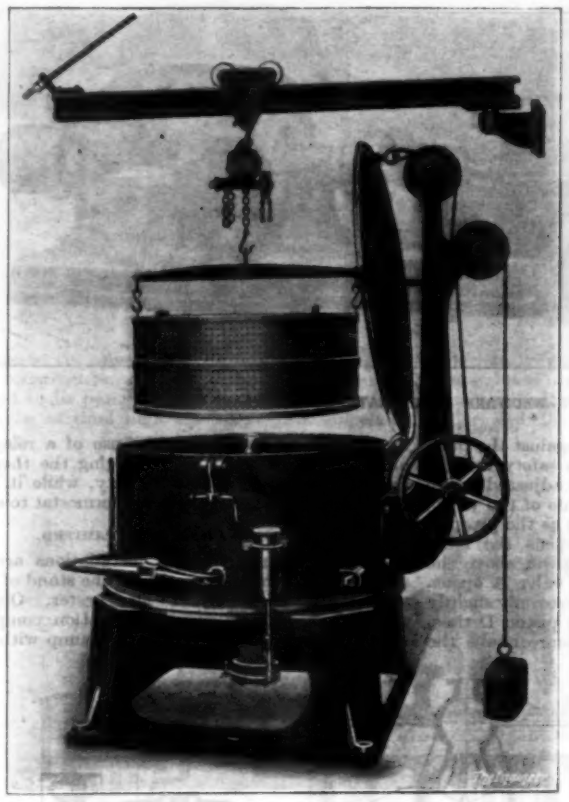


FIG. 292—HAND-POWER DEPERICARPER

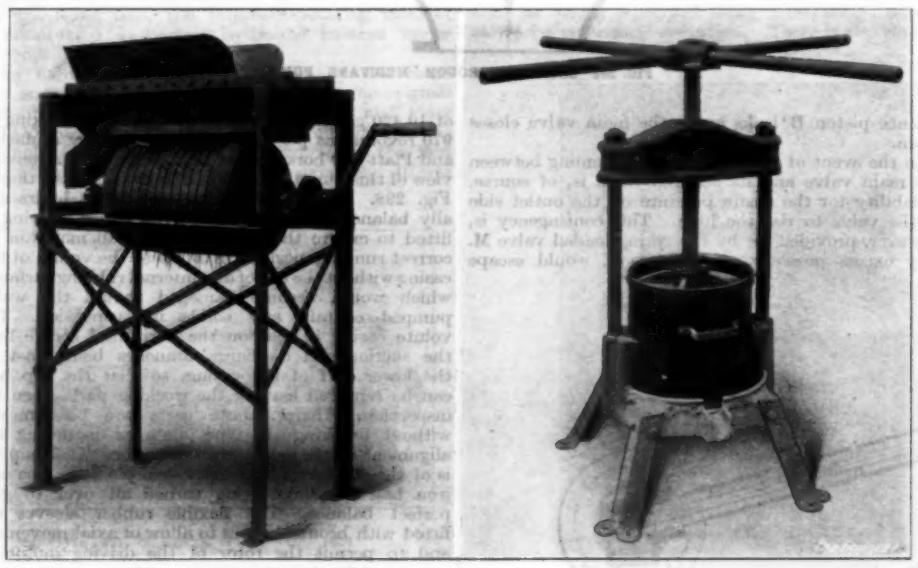


FIG. 293—HAND-POWER PRESS

THE STEAM FITTINGS COMPANY, LIMITED.

On the stand of the Steam Fittings Company, Limited, of West Drayton, Middlesex, which is in the building section of the Palace of Industry, there is a wide variety of valves and such devices, the character of which is well indicated by the title of the firm. One of the most interesting parts of the display is, however, a quantity of flexible metallic tubing. This tubing is seamless throughout, and its flexibility is derived from the fact that it has a deep spiral corrugation of close pitch in its surface. It is made of very thin tough brass, and the flexibility is provided by the deformation of the corrugations, which close up on the inside of the curve and open on the outside. The tubing has not the free flexibility of that type which has a helical joint, but it can be bent without any great force round quite sharp curves. A piece of about ¾in. bore can, for instance, be bent to 1in. radius by the hands. The tubing is made for pressures up to 600 lb.

For low temperatures the fittings are sweated on to the tube with solder, but a form of screwed connection gripping the corrugation has been devised for cases where solder cannot be used. The same kind of tubing, only with steeply pitched corrugation, provides an excellent form of heating surface for feed-water heaters and such purposes, while by greatly exaggerating the depth of the corrugation, the tube can be made so elastic, longitudinally, that it forms an excellent substitute for the diaphragm boxes used in barometers and similar instruments.

Among the great variety of steam fittings shown on this stand, two of the most interesting are the "Transfer" valve—illustrated by Fig. 294—and a reducing valve—see Fig. 295. The transfer valve is intended for use on installations in which there are boilers working at a higher pressure than the remainder of the plant, and which may occasionally have a surplus output that could be utilised in the low-pressure system.

On reference to the drawing—Fig. 294—it will be seen that the valve A is of the balanced single-beat type, and opens against the steam pressure. Inside the main valve there is a small relief valve B, which is fixed on the spindle of the working piston C. The lower part of the cylinder for C is open to the boiler pressure by the hole D, and acts as a dashpot. The upper face of the piston is also subject to the full pressure through the small passages E. The space above the working piston can be put in communication with the outlet side of the main valve, by way of the port F, when the valve G is open. This valve is under the control of the spring-loaded diaphragm H beneath which the full boiler pressure acts.

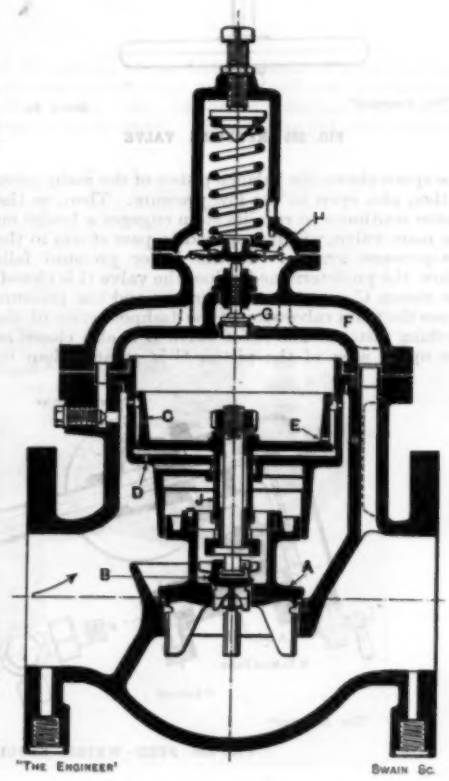



FIG. 294—TRANSFER VALVE

The operation of the valve is as follows:—In normal conditions the pressure on the two sides of

the piston C will be the same, and the main valve A will be forced down on its seating by the boiler pressure. In the event of the boiler pressure rising above the amount at which it is decided that steam shall be transferred to the other system, the spring of the diaphragm H is compressed and the valve G opened. The space above the piston C is then open to the low-pressure side of the valve, and as the ports E are quite small the pressure in this space falls. The piston C consequently rises and opens the valve B.

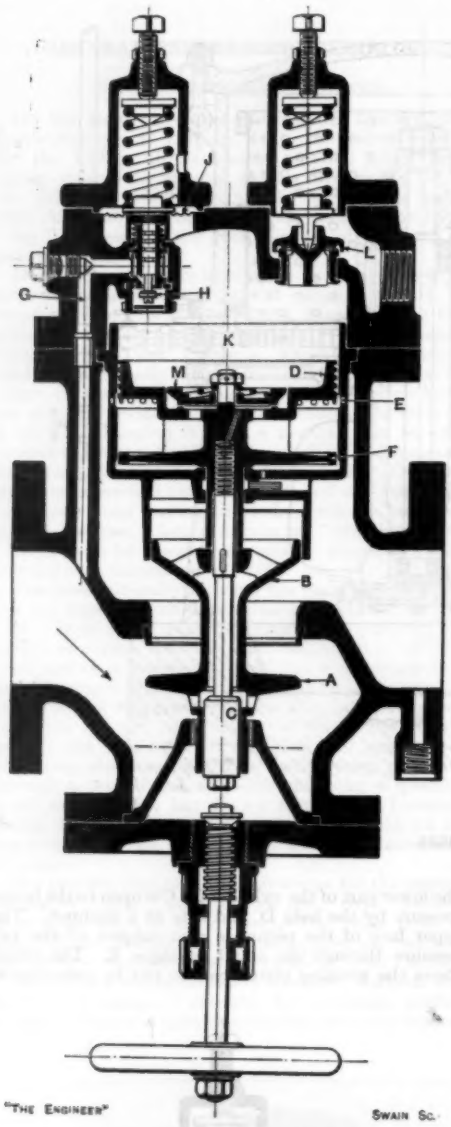



FIG. 295—REDUCING VALVE

The space above the balance piston of the main valve is then also open to the low pressure. Then, as the piston continues to rise, its stem engages a bridge on the main valve, which is opened to pass steam to the low-pressure system. If the boiler pressure falls below the predetermined value, the valve G is closed, the piston C is put in equilibrium, and the pressure closes the main valve against the dashpot action of the working piston. The relief valve B is also closed as the upper area of the piston C is greater than its underneath surface to the extent of the sleeve J, which projects into the low-pressure space.

The reducing valve—see Fig. 295—is of rather unusual design, and has the merit that only a very small diaphragm is required. The main valve A is of the single-beat type, and can consequently be relied upon to close tight. It is balanced by the piston B, the upper face of which is in communication with the high-pressure side of the valve, *vid* the hollow stem and relief valve C. Movement of the relief valve is controlled by the working piston D, the space below which is filled with low-pressure steam by way of the holes E. The disc F is merely a dashpot piston. The space K above the piston D is supplied with steam from the high-pressure side, through the passage G, but its pressure is reduced by the little valve H under the control of the spring loaded diaphragm J. The valve H is protected by strainers on each side. As an added precaution against the pressure in the space K rising too high, a safety valve L is provided. This loading pressure is adjusted to the value required on the low-pressure side of the valve, and forces down the piston D so long as the pressure below is lower. This movement opens the relief valve C, and admits high-pressure steam above the balance piston B, so that the main valve A opens. When the pressure on the outlet side rises only slightly above the loading pressure in K, the piston D rises, the valve C closes, and as the pressure above the balance piston B leaks away the main valve closes again.

In the event of any solid matter jamming between the main valve and its seating, there is, of course, a liability for the steam pressure on the outlet side of the valve to rise too high. This contingency is, however, provided for by the spring-loaded valve M. Any excess pressure, within reason, would escape by the holes E, through the piston D, by way of the valve M, and then to atmosphere by the safety valve L.

The feed-water regulator shown in Fig. 296, by the same makers, is of the thermostatic type, and is unusually compact for this class of apparatus. It comprises an inclined tube, having a very low coefficient of expansion connected with the steam and water spaces of the boiler. Inside the tube there is a rod of metal having a high coefficient of expansion. The rod passes out of the upper fitting on the tube through a stuffing-box, and carries two cone points which engage a lever. The lever also is fulcrumed on cone points, and is used to operate a small piston valve. This valve, in turn, controls a supply of steam or water—the latter is preferable—to the working cylinder of a valve in the feed-water pipe.

The action of the apparatus is similar to that of others in the same class, and needs no description, but it is noteworthy that the use of a relay valve obviates the necessity for arranging the thermostat and feed valve in close proximity, while it reduces the effort it is necessary for the thermostat to exert.

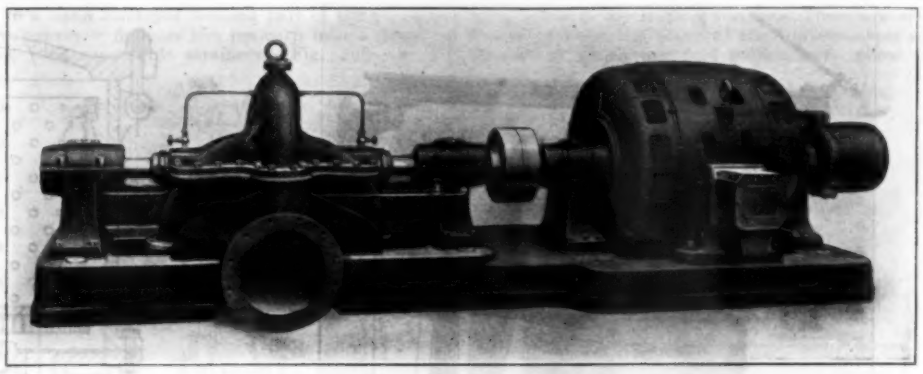


FIG. 297—MEDIVANE PUMP—MATHER AND PLATT

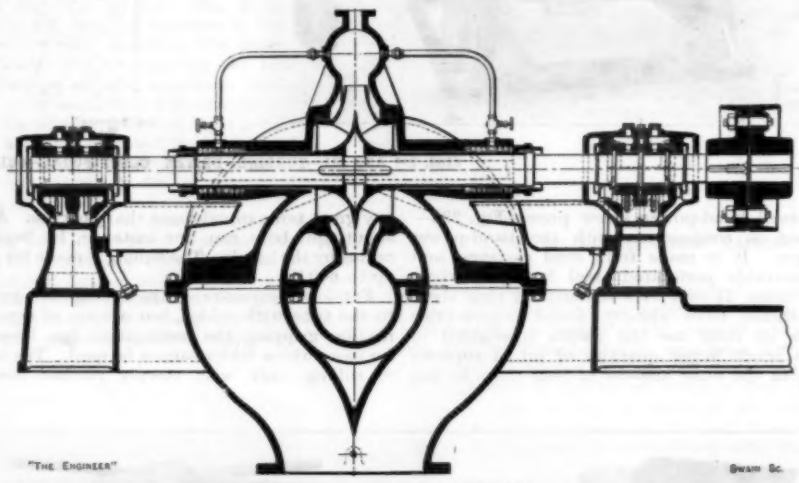



FIG. 298—SECTION THROUGH MEDIVANE PUMP

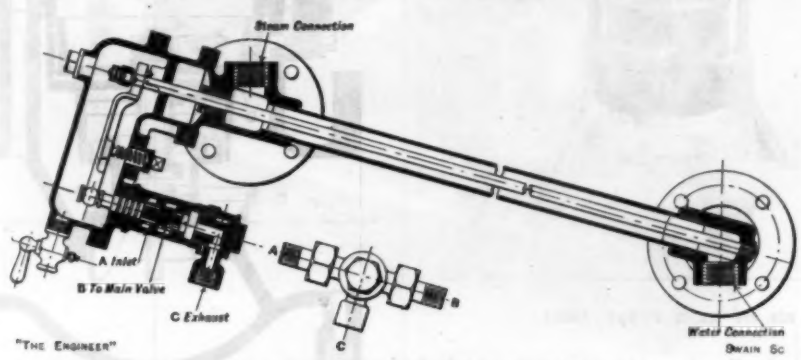



FIG. 296—FEED-WATER REGULATOR—STEAM FITTINGS COMPANY

MATHER AND PLATT, LIMITED.

Several turbine pumping installations are to be seen in the mechanical section of the stand of Mather and Platt, Limited, of Manchester. One constructed for the Calcutta Corporation comprises a high efficiency 18in. "Medivane" pump with a duty of 10,420 gallons per minute, 140ft. head working at 970 revolutions per minute, and driven by a Mather and Platt 580 horse-power electric motor. A general view of this pump is given in Fig. 297 and a section in Fig. 298. The double entry impeller is hydraulically balanced, but a marine type thrust bearing is fitted to ensure that the impeller shall maintain its correct running position relative to the volute of the casing without the use of any internal rubbing surfaces, which would become damaged should the water pumped contain any solids in suspension. The volute casing is split on the horizontal centre line, the suction and discharge branches being cast on the lower half of the casing, so that the top half can be removed leaving the working parts open for inspection. Hence, these parts can be removed without breaking the pipe joints or disturbing the alignment of the pump and its motor. The coupling is of the flexible rubber-bush steel-pin type, the cast iron half couplings being turned all over to give perfect balance. The flexible rubber sleeves are fitted with bronze bushes to allow of axial movement and to permit the rotor of the driving motor to operate at its correct magnetic centre.

For mining purposes, Mather and Platt, Limited, exhibit a six-stage "Plurovane" high-lift pump driven by one of the firm's mining type 100 horse-power electric motors. This pump is designed for a duty of 750 gallons per minute at 500ft. head and runs at 1450 revolutions per minute. It is of the multi-stage pattern, the body being divided into vertical sections securely held together by external bolts. This construction gives the greatest accessibility for dismantling and permits the insertion of an extra section should it be necessary at any time to increase the head.

A general view of this pump is given in Fig. 299, and a sectional elevation in Fig. 300. The suction

and discharge covers are designed so as to reduce all losses to a minimum. They are accurately machined with spigot and recess to receive the middle chambers, which are also machined. Owing to the design of the end covers and the internal guide passages, friction and shock are minimised, with advantage to the efficiency. Renewable tip rings of special construction and of material suitable for the liquid to be pumped contribute to the maintenance of the original high efficiency. The impellers are of the single inlet type, accurately machined to gauge, and so designed that, in conjunction with the balancing disc, the complete rotating element is maintained in perfect hydraulic balance under all conditions of working.

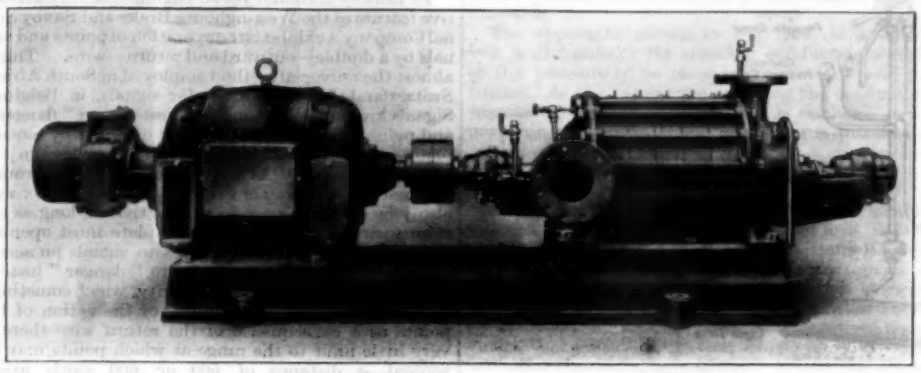


FIG. 299—SIX-STAGE TURBINE PUMP—MATHER AND PLATT

An exhibit of historical interest by the same firm is shown in the Mining Hall. It is the original high-lift turbine pump made by Mather and Platt in 1876 from the designs of the late Professor Osborne Reynolds, Fig. 301, and is claimed to be the first multi-stage turbine pump ever constructed. It was capable of lifting 2169 gallons per minute, against a head of 150ft., at 1500 revolutions per minute.

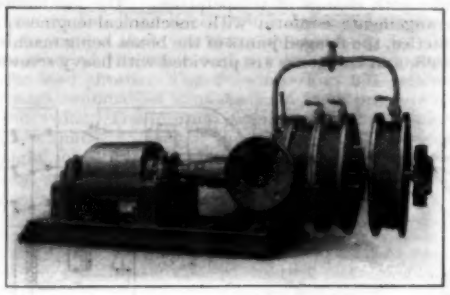


FIG. 301—TURBINE PUMP OF 1876

In the power-house in the Palace of Engineering are to be seen several auxiliaries, including a 10in. condenser circulating pump for J. Musgrave and Sons, Limited, a similar 12in. pump for Cole, Marchent and Morley, and a condenser extraction pump for the latter firm, all made by Mather and Platt. We may mention also that the cotton mill section is protected from fire by a complete Grinell automatic sprinkler and fire alarm installation, armoured fire doors and simplex chemical extinguishers, supplied by this firm.

### Westinghouse Brake and Saxby Signal Company, Limited.

In the exhibit of the Westinghouse Brake and Saxby Signal Company, Limited, 82, York-road, N. 1, many examples of the specialities for railway brakes and signalling with which that firm's name is associated are included. We may mention a compressed air brake for controlling an engine and tender and ten passenger coaches. Part of this equipment is provided for electro-pneumatic control as used in Australia and now on trial in England, as well as being equipped with graduating release valves for pneumatic operation. There is also shown, under working conditions, vacuum brake apparatus with the Westinghouse ejector and five diaphragm brake cylinders.

In view of the greater use of electrically-operated trains electrically driven air compressors for braking purposes call for special attention. They are of two types. One is the C.M. 38, having a capacity of 38 cubic feet of free air per minute, as used on the Underground Railways of London, and in South Africa and Japan. The other is the D.H. 25, which has a capacity of 25 cubic feet per minute, and is employed on the South-Western section of the Southern Railway, and has been specified for use on the South-Eastern section of the same system. They are very similar in appearance, and type D.H. is illustrated herewith—Fig. 302.

The compressor and motor are built to suit conditions of restricted space and clearance. For this reason the motor is placed at the side of the compressor instead of behind it. The compressor is of the single-acting horizontal duplex air cylinder type, having one suction valve and one discharge valve for each cylinder. These valves are placed vertically and close by gravity without the aid of springs. The motor is of the enclosed four-pole direct-current series wound salient pole type. The field yoke is of laminated steel, so ensuring uniformity of section and minimum weight. All parts are easily accessible for inspection or repairs. The removal of the crank case top cover or the commutator door exposes all parts of the motor. The oiling system is entirely automatic and requires no attention other than to replenish the oil supply in the crank case. This is the only place into which oil can be poured; one replenishment suffices for the longest permissible interval between the general inspections of the other equipment on the car.

One of the latest developments in power-operated brakes is their application to road vehicles which give to the drivers of the latter a brake of greater power, and one applied more quickly and with less muscular effort than the customary mechanically-applied foot or hand brake. These points not only make for greater safety, but the vehicle will get over the road in less time because of the greater confidence the driver has in his braking equipment. Foot or hand application is, moreover, still available for occasions when it is sufficient.

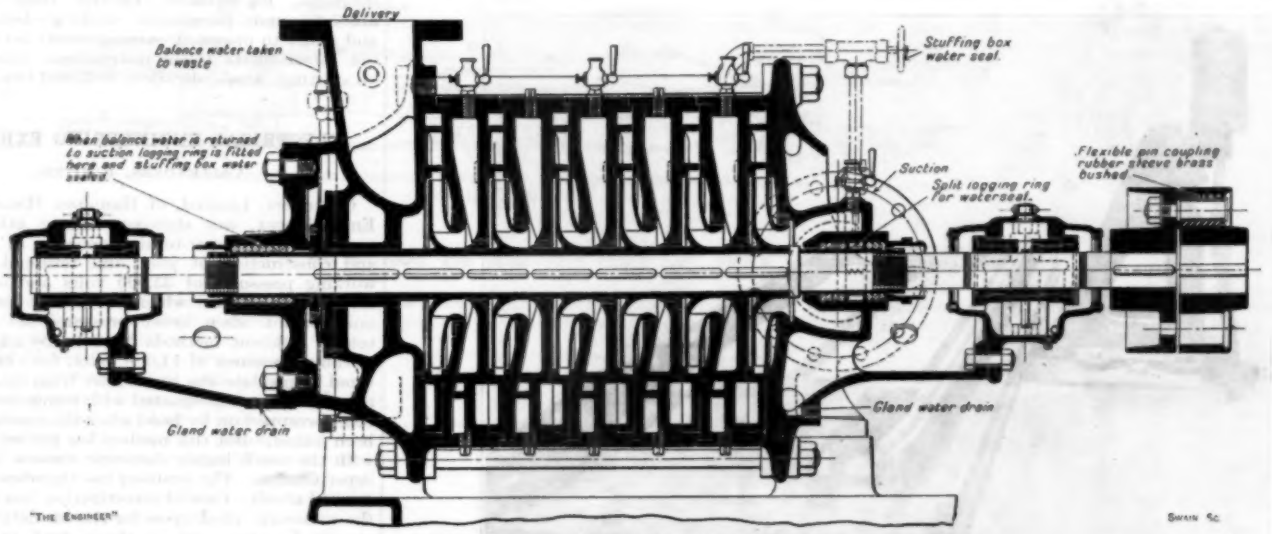

Delivery
Balance water taken to waste
When balance water is returned to suction logging ring is fitted here and stuffing box water sealed
Stuffing box water seal
Suction
Split logging ring for waterseal
Flexible pin coupling rubber sleeve brass bushed
Gland water drain
Gland water drain
"The Engineer"
Swain Sc.

FIG. 300—SECTION THROUGH SIX-STAGE TURBINE PUMP

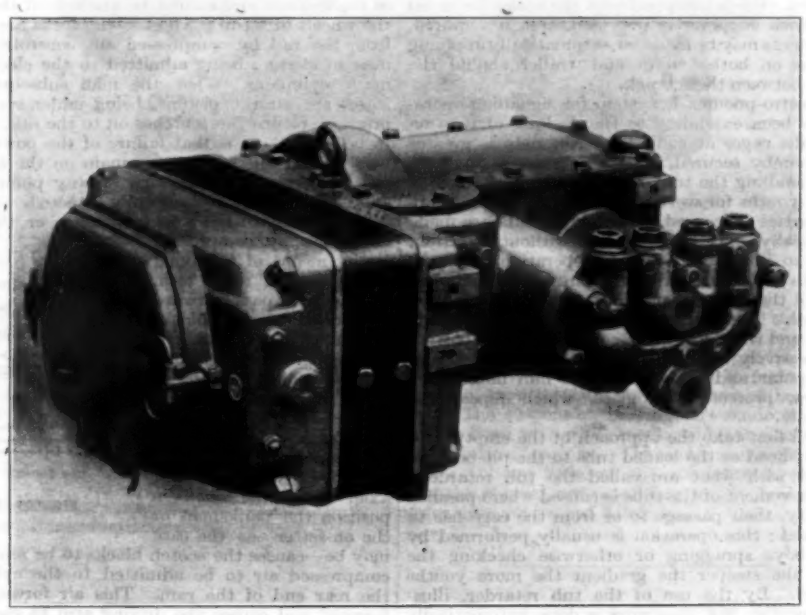


FIG. 302—ELECTRICALLY-DRIVEN AIR COMPRESSOR FOR BRAKES—WESTINGHOUSE-SAXBY

The principle is the same as with the compressed air brake on a train. Gas, in the case of petrol-driven vehicles, from the explosion chamber of the engine cylinders, or, in the case of steam or electrically-driven vehicles, air compressed by a suitably driven compressor, is stored in a reservoir. Thence the air or gas passes, as controlled by the driver's valve fixed on the steering gear, to the usual diaphragm brake cylinders, as shown on the accompanying diagram—Fig. 303. Vehicles with six wheels are braked as easily as those with four. Where there is a trailing vehicle equipped with the brake the usual flexible hose coupling is provided, and, if required, arrangements may be made for automatically applying the brake on both tractor and trailer should the coupling between them break.

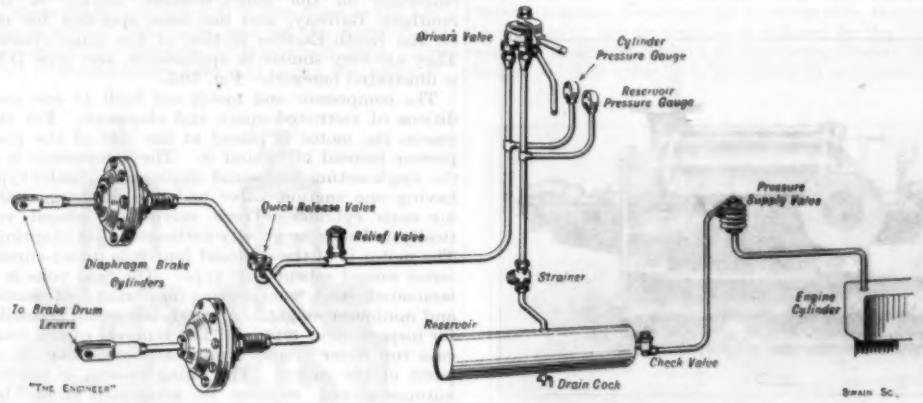



FIG. 303—DIAGRAM OF ARRANGEMENT OF POWER-OPERATED BRAKE—WESTINGHOUSE-SAXBY

The electro-pneumatic system for signalling operations has been extending to the decking of tubs on and off the cages at collieries. Not only is greater safety thereby secured, but the resultant abolition of men handling the tubs releases a large number of men and youths for work of a more profitable nature for all parties concerned. The movements are made automatically, expeditiously and without exertion, and are so interlocked that all operations are performed in sequence and none can be made unless and until the essential previous movement has been completed. The operations by the banksman at the pit head and those by the on-setter at the pit bottom are respectively controlled by these men at a convenient point, and each has before him illuminated indicators, protected by glass, which repeat the movements.

We will first take the approach of the empty tubs to the pit head or the loaded tubs to the pit bottom, and deal with what are called the tub retarders. As the movement of the tubs is caused where possible by gravity, their passage to or from the cage has to be checked; this operation is usually performed by several boys spragging or otherwise checking the wheels; the steeper the gradient the more youths employed. By the use of the tub retarder, illustrated by Fig. 304, this work is done automatically and without any manual aid. At the required spot the rails are replaced by angle pieces which work on a pivot and tilt outwardly as the tubs pass on to them. This action brings braking strips against the inner face of the rim of the wheels and thereby the tubs are held. As soon as the tub may move forward the man in charge moves a lever and compressed air is admitted to the cylinder, seen in the illustration, which restores the angles, thus taking the braking strips away from the wheels, and the tubs, being on a falling gradient, automatically move forward. For long or steep gradients there will be more than one retarder, and for each retarder provided there is a corresponding reduction in the staff.

The tubs will now reach the pit shaft and be ready to pass on to the cage. Here they are held from moving forward by scotch blocks, which rest normally on the rails so as to keep the tubs from being pushed foul of the shaft. They occupy a minimum of track space and cannot be pushed off the rails by the wheels of a tub. The scotch blocks are removed from the rail by compressed air, controlled by the man in charge, being admitted to the electro-pneumatic cylinders. When the man subsequently releases the air the pistons, being under spring compression, return the scotches on to the rail. A point to be noted here is that failure of the power supply would cause the blocks to remain on the rail, or, if off, to be put on. As with railway points the on and off positions are electrically detected.

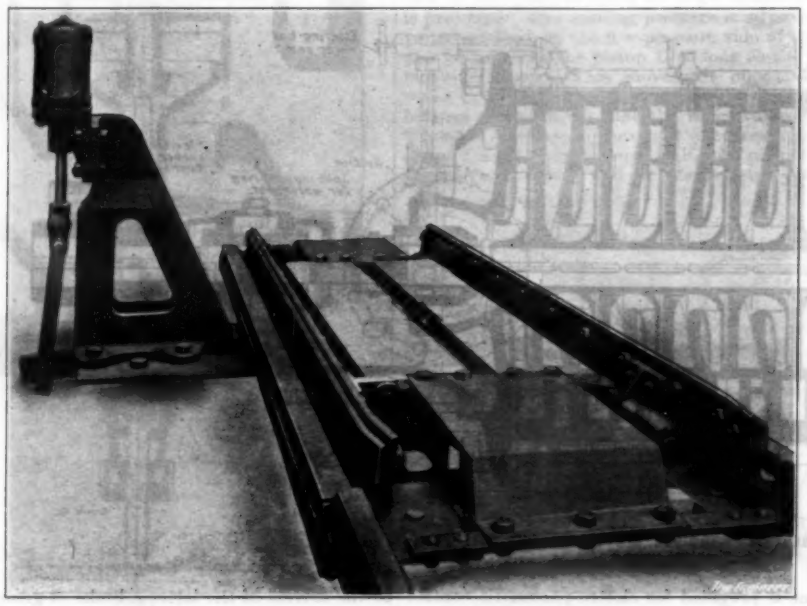


FIG. 304—COLLIERY TUB RETARDER—WESTINGHOUSE-SAXBY

The placing of the tubs in position on the cage is also done by compressed air by means of a driving arm attached to a ram. As the tubs pass forward towards the scotch blocks the axles pass over the driving arm in a trailing direction and depress it. It is spring-supported and so rises again after depression, and, when the tubs have passed, the forks are in alignment with the last axle. When the cage is in position the banksman or the on-setter—as the case may be—causes the scotch blocks to be removed and compressed air to be admitted to the cylinders at the rear end of the ram. This air forces the ram forward and causes the driving arm to engage with the rear axle and to force the tubs on to the cage. These tubs, in turn, push the arriving tubs off the cage without any manual assistance. This done, the man in charge admits air to the front of the cylinder of the ram, and it is reversed. He then releases the air from the cylinder of the scotch blocks, which then go on to the rail and the road is ready for another lot of tubs. Where cages have two or more decks the arrangements are practically the same but are modified to suit the altered conditions.

The electro-pneumatic operation of the main shaft gates, of the keps that support the cage at the pit top, and the locks that hold the tubs on the cage, is provided for. Communication between the control point and the winding engine-room is also given.

To railway civil and signal engineers a very attractive feature of the Westinghouse Brake and Saxby Signal Company's exhibit is the operation of points and signals by a double—outward and return—wire. This is almost the universal method employed in South Africa, Switzerland, Holland, and, for signals, in Belgium. Signals are put to "clear" and restored to "danger," and points are moved, locked and detected by motion plates around which the wire from the lever in the signal-box passes. As the wire after passing round the motion plate is continued back to the box and also joined to the lever, it follows that as long as the return wire is intact the motion plate must operate. This arrangement, further, gives to signals an actual movement to cause them to go to "danger" instead of, as is usual, depending on gravity, which sometimes fails. Because of the certainty of the action of the points as a consequence of the return wire there is very little limit to the range at which points may be worked—a distance of 500 or 600 yards would appear quite reasonable. The wires are correctly compensated for variations in the temperature, and the compensation device operates when the signals are at "clear" as well as when at "danger."

In the signalling section of this stand may also be seen in actual work various details of mechanical signalling, power signalling, automatic signals, daylight colour light signals, track circuits, illuminated diagrams, fog-repeaters, electric train staffs for absolute and permissive working—both battery and magneto operated—arrangements for switching-out intermediate token instruments, token control on starting signals, derailers, lock-and-block, &c.

## ELECTRICAL ENGINEERING EXHIBITS.

### Callenders, Limited.

Callenders, Limited, of Hamilton House, Victoria Embankment, are showing, among other things, accessories for super-tension cables. In the design and construction of joint and terminal boxes for working pressures of 33,000 volts and over, many considerations arise which are absent or relatively unimportant when lower pressures are used, and totally different methods have to be adopted. At working pressures of 11,000 volts, for example, it is usual to insulate the conductors from each other by means of tape impregnated with compound, the tape being wrapped on by hand after the conductors have been joined. But this method has proved unsuitable with the much higher dielectric stresses imposed by super tension. The problem has therefore had to be studied afresh. Careful investigation has shown that the materials relied upon for the insulation of joints should be the same as those used in the cable itself, and the thermal problems associated with the employment of large quantities of compound should receive as much consideration and attention in connection with the making of joints as it does in the manufacture, and dependence on the manipulative skill of the jointer should be reduced to a minimum.

The super-tension cable accessories exhibited conform with these requirements, and include a 55,000-volt, three-core straight joint, a 55,000-volt, three-core horizontal type dividing-box, a 55,000-volt, single-core sealing end, a 55,000-volt insulator, and a 33,000-volt three-core submarine joint. The insulation consists in each case of paper tubes and impregnating compound. Air vessels are provided to allow for changes of volume of the contents of the joint with change of temperature. The mechanical arrangements conform with mechanical engineering practice, the flanged joints of the boxes being machine faced, and the boxes are provided with heavy screwed brass glands. Moreover, all the boxes complete with their glands are tested under water with an air pressure of 50 lb. per square inch before they leave the factory.

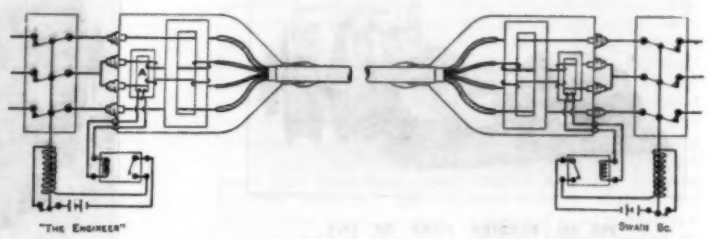


FIG. 305—FOUR-CORE CABLE WITH CALLENDER PROTECTIVE EQUIPMENT

Engineers responsible for the operation of large high-pressure transmission systems find it necessary to rely on automatic protective gear to an increasing degree. In the case of the four-conductor protective system, which is the latest of the various forms of automatic protective arrangements developed, Callenders provide the necessary protective equipment in the cable terminal boxes. The drawing—Fig. 305

—shows the arrangement for an 11,000-volt four-core cable. The lower part of the box provides for the

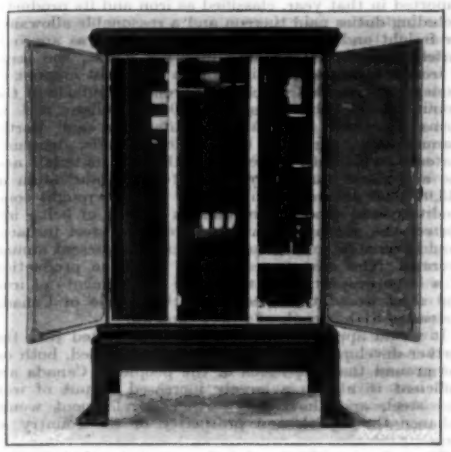


FIG. 306—TRANSFORMER PILLAR—CALLENDER

reception, dividing and sealing of the incoming cable, and above it the necessary protective transformers are housed, the connections to the switch-gear being taken from the insulators at the top of the box.

A transformer pillar exhibited—see Fig. A135—is capable of accommodating a 100-kilovolt-ampère three-phase transformer, and of dealing with a three-core 11,000-volt feeder looped in and out, and five low-tension four-core three-phase distributors. Doors on all sides of the pillar make the whole equipment accessible. The high-tension feeder cable is controlled by an automatic oil switch, and the incoming and outgoing cable is directly connected to isolating switches, which are disconnected by a hook. If desired, two oil switches can be provided. The transformer, the high-tension gear and the low-tension gear are all separated from each other by sheet iron partitions. The low-tension fuse equipment, which is constructed under the Callender-Watson-Smith patents, is claimed to offer a number of advantages. Accommodation is provided in the pillar for the necessary dividing boxes for the high and low-tension cables, and the pillar is supported on a skeleton frame. Similar pillars of smaller dimensions are made for transformers of lower capacity or for use with a voltage lower than 11,000 volts.

Sometimes it is necessary to lay a super-tension cable under water in lengths that involve the use of submerged joints. Additional security must be provided to prevent the entry of water into the joint, which is subjected to external pressure. It is necessary to protect the joint itself from mechanical stresses, and to ensure that the stress is taken up by the armouring of the cable and not by the conductors or the lead sheath. The drawing—Fig. 307—shows a straight submarine joint designed for a pressure of 33,000 volts. The internal arrangement of the joint itself is similar to that of the company's 55,000-volt straight joint, but the joint box is surrounded by a second external joint box fitted with special bell-mouthed packing glands at each end, the outer box being filled with black compound. Double-wire armoured cable is used, and at each end the armour wires are bent round armour clamps between which strips of antimonical lead are placed. These armour clamps at each end of the joint are connected together by means of four stout steel rods, which are screwed at each end to receive clamping nuts, and any pull which takes place on the cable is taken up across the joint by these rods attached to the armour wire of the cable.

The apparatus shown in Fig. 308 is a 55,000-volt wall insulator for enabling conductors working at this pressure to be passed through walls and partitions. As the paper tube enclosing the conductor is surrounded by compound which is enclosed in the porcelain insulators, treble insulation is provided.

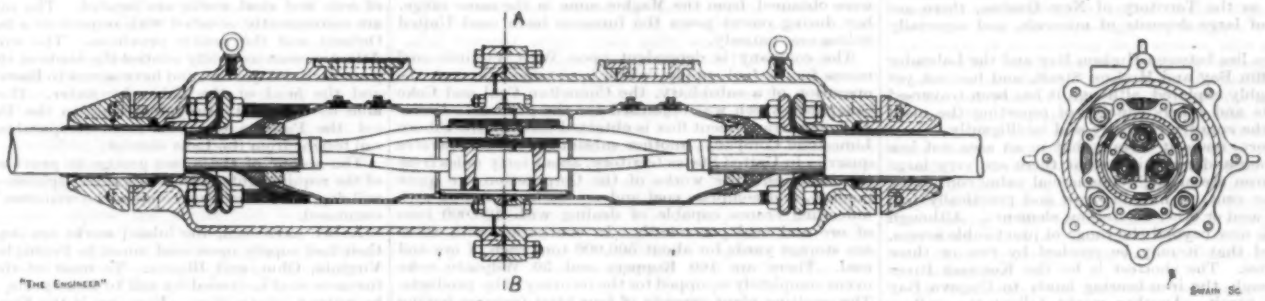



FIG. 307—JOINT FOR 33,000-VOLT CABLE LAID UNDER WATER—CALLENDER

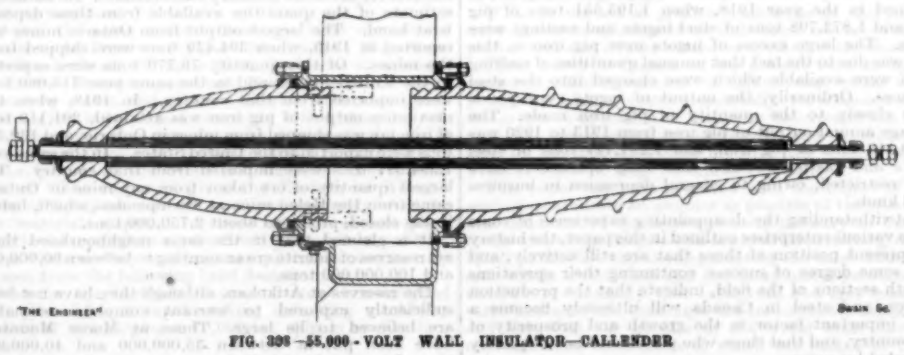



FIG. 308—55,000-VOLT WALL INSULATOR—CALLENDER

### The General Electric Company.

Although there are many electric traction exhibits in the Palace of Engineering, only one firm, namely, the General Electric Company, of Witton, Birmingham, is showing an alternating-current traction motor. Up to the present, nearly all the British electrical manufacturers have failed to pay attention to the development of alternating-current traction equipments, notwithstanding that single-phase traction has made considerable headway. Whilst the general opinion in this country appears to be that direct current is suitable for all classes of railway work, there are many engineers abroad who do not share that view. An immense amount of railway electrification work remains to be undertaken in various parts of the world. In some cases alternating-current equipment will undoubtedly be called for, and it is a matter of regret that foreign visitors to the Exhibition should find that only one British firm is showing an alternating-current traction motor. The machine in question—which is illustrated in Fig. 309—was built for the Brighton section of the Southern Railway, to the specification of Sir Philip Dawson, to whom we are indebted for the following particulars. The motor is of the series compensated type, the stator having compensating and commutating coils. For control purposes contactors give pressure steps of 110, 134, 153, 174, 196, 219, and 234 volts. The gear ratio is 1 to 3.44, the road wheels being 43½in. in diameter. A temperature rise of 135 deg. Fah. was specified for the windings, and 162 deg. Fah. for the commutator, and with these temperatures the one-hour rating of the machine proved to be 293 horse-power, with forced ventilation, and 259 horse-power with natural ventilation; whilst the continuous rating with forced ventilation was 227 horse-power, and that with natural ventilation 175 horse-power. Including the gear losses, the efficiencies at various loads are as follows:—120 horse-power, 82 per cent.; 160 horse-power, 85 per cent.; 200 horse-power, 86 per cent.; 250 horse-power, 86 per cent.; and 300 horse-power, 86 per cent. The power factor is in the neighbourhood of 90 per cent. With temporary loads of 375 horse-power there is no appreciable sparking. On test the motor was run up to a speed of 1710 revolutions per minute, corresponding to a train speed of 64 miles per hour, and the balance of the armature at that speed was found to be good. All the motor windings were tested at an alternating-current pressure of 2500 volts for a period of 5 minutes. These motors, which have eight poles, are arranged to work with natural or forced ventilation, and in the former case the air is provided by means of a twin fan fitted on the armature shaft at the commutator end. The fan draws the air through the armature and through the ducts at the back of the stator core. The armature windings are of the usual wave type, each coil consisting of insulated copper bars, which are bent to the correct shape on a former, and the coils are fixed in the slots by means of hard wood keys. The suspension bearings are made of bronze, and are lined with white metal, which is also used for the armature bearings. The root mean square value of the voltage between the commutator segments with the current corresponding to 250 brake horse-power does not exceed 3.9 volts.

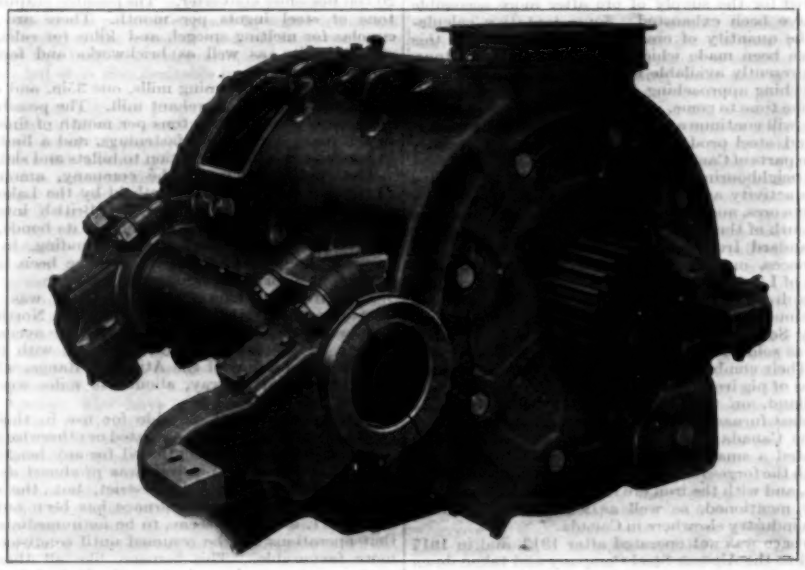


FIG. 309—SINGLE-PHASE RAILWAY TRACTION MOTOR—GENERAL ELECTRIC COMPANY

---

The ship and yacht building yard at Itchen, Southampton, which has been lying idle for months, having never been put into order following the devastating fire, has now been secured by a new firm, named White's Southampton Yacht Building and Engineering Company. Yacht building, ship repairing and engineering will all be carried out, but before any real start can be made, the yard will have to be thoroughly cleaned up and the machinery overhauled. A joiners' shop, saw mill and building shop will also have to be erected.

# The Iron and Steel Industry in Canada.*

By CHARLES SYMONDS CAMERON, Secretary, British Empire Steel Corporation, Limited.

(*Concluded from page* 113.)

## Western Canada.

Going westward, the province of New Brunswick contains a deposit of iron ore upon which some initial development work has been done, and which was connected with the main railway line near Bathurst on the Baie des Chaleurs, and thence with a shipping pier at Newcastle. Beyond the mining and shipment of less than two hundred thousand tons of ore no further progress has been made.

In the Province of Quebec, although iron was produced from native ores nearly two hundred years ago, and although some forges there were among the earliest producers of iron in the American continent, the industry never made any material progress, and has completely died out.

Sooner or later this province may again become an active producer of iron, and in large quantities. Although it possesses no reserves of coal, a substitute may be found in water power, for the development of which there are large possibilities. In the region north of the St. Lawrence estuary and east of the Saguenay River there are deposits of iron ore which have received only passing attention, owing to the presence of a varying percentage of titanium. At several places on the lower St. Lawrence there are deposits of magnetic sands from which at one time it was expected that iron could be produced commercially, but this has not yet been accomplished. In the region recently added to the province in the district of Ungava, and known as the Territory of New Quebec, there are indications of large deposits of minerals, and especially of iron ore.

This region lies between Hudson Bay and the Labrador coast of Baffin Bay and Hudson Strait, and has not yet been thoroughly explored, although it has been traversed by geologists and others capable of reporting the main features of the country correctly and intelligently.

Their reports make it certain that in an area not less than two thousand miles in extent there are very large deposits of iron ore of high commercial value containing above 50 per cent. of metallic iron and practically free from titanic acid or other deleterious elements. Although this region is now beyond the range of practicable access, it is claimed that it may be reached by two or three feasible routes. The shortest is by the Koksoak River flowing through the iron-bearing lands to Ungava Bay on Hudson Strait. Another might follow the valleys of a chain of rivers and lakes flowing to Hudson Bay, and it is suggested that a third outlet may be found southward to the estuary of the St. Lawrence, west of Anticosti. Apart from the possibilities that attach to the utilisation of water power for smelting near these deposits, it would appear that their chief value will be as a reserve for the supply of ore after more accessible sources have been exhausted. Some tentative calculations of the quantity of ore that may be found in this region have been made which run into billions of tons, but data presently available is probably not sufficient to ensure antyhing approaching accuracy. For the present, and for some time to come, it is probable that the province of Quebec will continue as it now is, an important market for iron and steel produced in the other and especially the eastern parts of Canada.

In the neighbouring province of Ontario there have been more activity and greater development, at first by use of native ores, and later by drawing from the American deposits south of the Great Lakes.

The Standard Iron Company, Limited, operated two small furnaces, one at Deseronto in Hastings County, just north of Lake Ontario, and the other at Parry Sound, using ores drawn from deposits in that neighbourhood for some time, but with a gradually diminishing output. The Parry Sound furnace was idle from 1913 to 1918, when it was sold to the Parry Sound Iron Company and rebuilt. Their combined output in 1919 was only about 30,000 tons of pig iron.

At Midland, on the Georgian Bay, Lake Huron, a modern blast-furnace was erected about fifteen years ago by the Canada Iron Corporation, which previously had operated a small furnace there, and had been connected with the forges formerly in operation in the province of Quebec, and with the iron ore mines in New Brunswick, previously mentioned, as well as with other branches of the iron industry elsewhere in Canada.

This furnace was not operated after 1913, and in 1917 it was sold to the Algoma Steel Company and taken down and re-erected at their works at Sault Ste. Marie.

At Port Colbourne, on Lake Erie, in the Niagara district, there is a comparatively new blast-furnace, owned and operated by the Canadian Furnace Company, Limited, which is understood to be entirely controlled by American interests, and which uses ore and coke imported from the United States, but which has also used ore from Hastings County, Ontario.

The most important works on the lower Lakes are those of the Steel Company of Canada, Limited, at Hamilton, on Lake Ontario, about forty miles from the city of Toronto.

This company, which was organised in 1910, was formed by the amalgamation of the Hamilton Steel and Iron Company, Limited, established in 1896, and operating blast-furnaces and steel works at Hamilton; the Montreal Rolling Mills Company, established in 1868, and operating rolling mills and other works at Montreal for the production of bars, wire nails, and other forms of finished steel; the Canada Screw Company, Limited, at Hamilton; Dominion Wire Manufacturing Company at Lachine, near Montreal; and the Canada Bolt and Nut Company, Limited, with plants at six different points in Ontario. The capital of the company issued amounts to about 18,000,000 dollars, in addition to mortgage bonds, of which there are about 8,000,000 dollars outstanding. Part of these securities are held in Great Britain. The several properties of this company combine to give it a very wide market throughout the Dominion for the varied output of its works. Most of these, as appears from the names of the companies by which they were formerly owned, are users of materials produced by the parent company of Hamilton.

It is with the operation of its works as a producer of the primary forms of iron and steel that this paper is concerned. These consist of two blast-furnaces, eight open-hearth steel furnaces, four of 80 tons and four of 50 tons capacity, rolling mills for the production of billets, wire rods, and small plates, coke ovens and plant for the recovery of by-products. They have a possible annual output of about 320,000 tons of steel ingots, and of a quantity of pig iron in excess of their own requirements. The whole of the ore and coal required for their operation is imported from the United States. The sources of supply there are within easy reach by water. The company has an interest in coal properties, which ensure its fuel requirements.

The works of the Algoma Steel Corporation, Limited, are at Sault Ste. Marie, where the Lakes Superior, Michigan and Huron practically come together. They are conveniently situated with respect to the Canadian territory contiguous to those lakes, and to Western Canada generally. Like the other Canadian steel companies, the Algoma Steel Corporation is a merger of a number of companies, the most important of which were the Algoma Steel Company, incorporated in 1901, the Lake Superior Iron and Steel Company, incorporated in 1907, the Lake Superior Power Company, and the Algoma Ironworks.

The original source of iron ore used at Sault Ste. Marie was at Michipicoten, in Canadian territory, where it is claimed that there are large reserves. The company formerly worked the Helen mine in that locality, but the ore tributary to its workings has been exhausted. For some time a portion of the company's requirements were obtained from the Maghie mine in the same range, but during recent years the furnaces have used United States ores entirely.

The company is dependent upon West Virginia coal mines for its fuel supply, which is obtained through the operation of a subsidiary, the Connelton Coal and Coke Company, which was organised for the purpose. Under a similar arrangement flux is obtained through the Fiborn Limestone Company, another subsidiary, which operates quarries in United States territory, about forty miles from the furnaces. The works of the Corporation are quite modern, and comprise coal and ore docks equipped with unloading cranes capable of dealing with 400,000 tons of ore and coal per month. In connection with these are storage yards for about 500,000 tons each of ore and coal. There are 160 Koppers and 50 Wilputte coke ovens completely equipped for the recovery of by-products. The smelting plant consists of four blast-furnaces having a possible output of 45,000 tons per month. The waste gases are utilised for the generation of power through the use of gas engines. The steel department consists of a 300-ton mixer, eight 50-ton and three 75-ton open-hearth furnaces, and a duplex process equipment made up of a 150-ton mixer, a 150-ton tilting furnace, and a 20-ton Bessemer converter. The possible output is 55,000 tons of steel ingots per month. There are also five cupolas for melting spiegel, and kilns for calcining lime and dolomite, as well as brickworks and facilities for sintering flue dust.

There are two blooming mills, one 35in. and one 32in., and a rail mill and merchant mill. The possible output of these is about 35,000 tons per month of finished steel in the form of rails, rail fastenings, and a limited range of bars and shapes, in addition to billets and slabs.

The capital stock of the company, amounting to 25,000,000 dollars, is entirely held by the Lake Superior Corporation of Philadelphia, but British interests are believed to hold a large proportion of its bonds, of which about 21,250,000 dollars are outstanding, in addition to some 4,000,000 dollars, which have been issued and pledged as security for temporary loans, &c.

The Atikokan Iron Company, which was promoted by parties connected with the Canadian Northern Railway, erected a blast-furnace and coke ovens at Port Arthur, at the head of Lake Superior, with the object of utilising the ores of the Atikokan Range, which is on the line of that railway, about 140 miles west of Port Arthur.

These ores are not suitable for use in their natural condition, and require to be roasted or otherwise improved.

Operations were not continued for any length of time. A small quantity of pig iron was produced and sent to market in the lower Lake district, but the enterprise was not a success. The furnace has been out of blast since 1911, and there seems to be no immediate prospect that operations will be resumed until conditions become more favourable. This furnace, like all those of the western group, is dependent on the United States for its fuel supply.

This completes our survey of the principal means for the production of the primary forms of iron and steel in Canada, in respect of which it may be said that, as a whole, they have rarely, if ever, produced the maximum quantities for which they were designed. The largest output was attained in the year 1918, when 1,195,551 tons of pig iron and 1,873,708 tons of steel ingots and castings were made. The large excess of ingots over pig iron in this year was due to the fact that unusual quantities of melting scrap were available which were charged into the steel furnaces. Ordinarily, the output of ingots corresponds more closely to the quantity of pig iron made. The average annual output of pig iron from 1913 to 1920 was 1,030,149 tons of pig iron, and 1,291,177 tons of steel ingots and castings. Since that time operations have been restricted, owing to general depression in business of all kinds.

Notwithstanding the disappointing experience of some of the various enterprises outlined in this paper, the history and present position of those that are still actively, and with some degree of success, continuing their operations in both sections of the field, indicate that the production of iron and steel in Canada will ultimtely become a most important factor in the growth and prosperity of the country, and that those who persist will be adequately rewarded by success.

The fiscal year ending March 31st, 1923, is the last for which complete returns are available, and although the total trade of the Dominion in that year was considerably less then than it was in the years between 1917 and 1921, it may be taken as an index of the average that may be expected in the immediate future. The value of goods imported in that year, classified as iron and its products, including duties paid thereon and a reasonable allowance for freight and other importation charges, was approximately 185,000,000 dollars; in other words, the users of iron and its products in Canada paid that amount of money for materials which were produced outside of the Dominion. Of this about 50,000,000 dollars was in forms described as iron unmanufactured and partly manufactured, pig irons, billets, blooms, rails, structural material, wire rods, plates, &c. If these materials and the additional quantity required for the fabrication of 135,000,000 dollars worth of more highly wrought commodities were produced in Canada instead of being imported, the output of Canadian iron and steel furnaces would probably be three or four times the present annual average. The advantages arising from the production of a large proportion of their own requirements of iron and steel would then accrue to the people of Canada instead of to the people of other countries.

It would appear from what has been stated that the further development of the industry is justified, both on the ground that the needs of the people of Canada are sufficient to absorb a largely increased output of iron and steel, and that such further development would enhance the wealth and prosperity of the country at large.

There is an additional inducement to that further development in the fact that some of the works already in existence are fitted by their position, equipment, and resources to undertake export business and to enter and occupy a large field in other countries.

The population of Canada is pretty evenly divided between the districts in which the two principal groups of iron and steel works are located. The inland works are conveniently situated with respect to a large part of Ontario and the prairie provinces. The works on the Atlantic coast naturally control the trade of the maritime provinces and Quebec, and have access to Eastern Ontario, and the head of the Lakes by water. They are also able to transport heavy materials to the Pacific coast *vid* the Panama Canal at rates comparable with the rail freight from the Lake district.

The ability of these two groups to provide the whole of the requirements of their respective spheres of influence will depend in large degree upon the resources which they command.

As we have seen, the inland works are dependent for their fuel supply upon coal mines in Pennsylvania, West Virginia, Ohio, and Illinois. To most of the Canadian furnaces coal is carried by rail to Lake ports, and thence by water to destination. Furnaces in the Niagara district can bring their coal or coke from the mines or ovens the whole way by rail.

The reserves of coal in the States named and in adjoining territory are very extensive, and except for the possibility of governmental interference may be regarded as an adequate and lasting source of supply for a much larger industry than is now within the reasonable expectation of Canadian furnacemen in the Lake district. Much of this coal is of good quality for metallurgical purposes, and is so placed that it may be obtained without excessive cost. As has been noted, the larger companies have proprietary interests in collieries from which they procure their fuel supply. The fact should not be overlooked that these reserves lie entirely outside the Dominion.

With respect to their ore supply, the position of these works is somewhat different. At present and until the demands of its owners in the United States make it necessary or advisable for them to restrict the export of iron ore, or until the cost of American ores so increases as to make them as expensive as the native ores, Canadian furnacemen will probably rely on them for their requirements. It is well known that the deposits in the Lake region south of the international boundary are not illimitable, and that enormous quantities are being taken from them every year. Some authorities predict their exhaustion soon after the middle of the present century. Unless new sources of supply are discovered, it is natural to expect that the people of the United States will begin to conserve their resources for their own use, and that the needs of Canadian smelters must be provided elsewhere. It is also a matter of common knowledge that the cost of Lake Superior ores is steadily rising, and that there is a gradual depreciation in the average iron content. These circumstances will have the effect of increasing the value of Canadian ores and of hastening the time when it may become commercially possible to use them.

As to the extent and quality of the iron ores of Ontario, it is difficult to procure exact information. It is claimed that large bodies of ore exist, and considerable quantities have been mined. At present three important deposits are known. Two of these lie north of Lake Superior, one near the lake at Michipicoten, the other at Atikokan, about 140 miles west of Port Arthur. The third is north of Lake Huron, at Moose Mountain, near Sudbury. The ores for the most part require treatment to make them suitable for use in the ordinary blast-furnace. No authentic estimate of the quantities available from these deposits is at hand. The largest output from Ontario mines was reported in 1915, when 394,429 tons were shipped from the mines. Of this quantity 79,770 tons were exported to the United States, and in the same year 715,060 tons were imported from that country. In 1918, when the maximum output of pig iron was attained, 201,119 tons of iron ore was shipped from mines in Ontario, and 130,250 tons were exported to the United States. In the same year 1,394,687 tons were imported from that country. The largest quantity of ore taken from any mine in Ontario came from the Helen mine at Michipicoten, which, before it was closed, produced about 2,750,000 tons.

It is claimed that in the same neighbourhood there are reserves of siderite ore amounting to between 60,000,000 and 100,000,000 tons.

The reserves at Atikokan, although they have not been sufficiently explored to warrant complete estimates, are believed to be large. Those at Moose Mountain have been put at between 35,000,000 and 40,000,000 tons of ore, or about half these quantities of concentrates carrying 63 per cent. iron and 6.66 per cent. silica.

In addition to these and many smaller deposits in the

* Paper presented to the Empire Mining and Metallurgical Congress.

older parts of Ontario, there are in the unexplored regions of the northern part of that province large areas of iron-bearing rocks at different points which are not within easy access at the present time, and which have not been thoroughly explored.

It is evident that there is material available, either from abroad or at home, for the development of a much larger iron and steel industry on the Canadian side of the Great Lakes than has yet been attempted.

The Government of Ontario this year authorised the payment of a bounty of half a cent. per unit on all iron ores and concentrates taken from mines and used by furnaces in that province. It is expected that this will induce a greater development of its mineral resources.

The resources upon which the works in Nova Scotia depend are well defined and extensive. They include practically the whole of the coalfields in that province, to which reference has already been made, and which have been very thoroughly explored. The quantity of available coal which they contain has been variously estimated, according as opinions differ as to the distance to which submarine operations may be practicable and the thickness of seams that may be worked. The minimum is probably not less than 4,000,000,000 tons, and the maximum may be double that quantity. The lower estimates are limited to seams of 3½ft. and over, and to depths of 2500ft. within three miles from the shore line. Although much of the coal is not entirely suitable for metallurgical purposes without washing, a large proportion of it can be made into furnace coke with only a moderate amount of preparation. The whole of the Eastern Cape Breton field is contained within a radius of 15 miles from the furnaces. The seams are evenly laid down, sloping gently seaward, and are free from serious faults or disturbances.

With respect to the Wabana ores, which are entirely controlled by the British Empire Steel Corporation, the following description is condensed from Edwin C. Eckel's work on Iron Ores, published in New York and London in 1914.

They are sedimentary ores, of a higher grade in iron than most other ores of that origin. The total tonnage present makes up one of the very largest and by far the most compact ore reserves in the world. . . . Disregarding seven or eight ore beds which are present, but too thin to be workable, the ore reserves of this field are contained in three beds, the topmost in workable thickness from 5ft. to 8ft., averages about 6ft.; 60ft. below it comes the Scotia bed. This is about 8ft. thick at all portions of its exposure. Below the Scotia bed comes 350ft. of shales between it and the Dominion bed. This last ranges from 12ft. to 20ft. in thickness ordinarily, though in one portion of the submarine workings a thickness of 33ft. was measured. Taken throughout the entire explored area, the Dominion bed will probably give an average workable thickness of close to 16ft. The three workable beds taken together give an average aggregate thickness of 30ft. over the entire area so far explored. As the ore is very dense, averaging about 9 cubic feet to the ton, we may assume that each square mile of the ore field contains at least ninety million tons of ore.

The possible quantity of ore in these beds may be as high as 10,000,000,000 tons, of which it may be safe to assume that the recovery will be approximately 50 per cent. of the total ore available. In Sjögren's estimate of the ore reserves of the world he puts the Newfoundland ores at 3,635,000 tons, or 135,000,000 tons more than the Lake Superior deposits. Without making allowance for further discoveries that may be made, it seems probable that the Wabana field contains one-third of all the available ore in North America.

In grade and composition Wabana ore is a dense, fine-grained red hæmatite ranging from 48 to 57 per cent. in metallic iron with 6 to 12 per cent. silica. The phosphorus ranges from 0.70 to 0.85 per cent.; as to other ingredients, a typical complete analysis shows sulphur 0.018 per cent.; lime, 1.80 per cent.; manganese, 0.65 per cent.; and alumina, 3.55 per cent. It requires no preparation, and can be used in an ordinary blast-furnace as it comes from the mine.

Located as they are on deep water, the Wabana ores have a very extensive possible market value.

Although these deposits have only been known since 1893, and have not been at all intensively worked, more than 5,000,000 tons of ore have been shipped to British and foreign markets in addition to what has been smelted in the works of the Corporation in Nova Scotia, which amount to about 12,500,000 tons, and from which about 6,000,000 tons of pig iron have been made.

Mining is done through slopes which start from the outcrop on Bell Island and follow the ore towards and under the sea upon a gentle incline. The beds are, for the most part, regular and unbroken, though varying in thickness at different places.

Ships carrying 12,000 tons can lie afloat at all tides, and can be loaded at the rate of 2000 tons per hour. The distance from the mines to the works at Sydney is about 400 miles; to Philadephia, 1242 miles; Middlesbrough, 2350 miles; to Rotterdam, 2294 miles.

The electric plants provide the power required for the operation of tramways and mining machinery and for lighting purposes.

Under the same control there are large deposits of limestone at Port au Port, on St. George's Bay, Newfoundland, about 150 miles from the works at Sydney; at Marble Mountain, in Cape Breton, about 50 miles distant by water, and at Point Edward and other places within a few miles of and connected with Sydney by rail. The companies also own dolomite quarries and beds of fireclay and silica rock, suitable for the manufacture of bricks for use at the ovens and furnaces. The possession of these resources gives the Eastern or Atlantic group of works assurance of an abundant supply of all the raw materials required for their operations, and place them in this respect in an absolutely independent position. These works as they now exist are quite extensive, as may be seen from the following brief description.

Piers for the discharge of ore and stone are equipped with powerful and rapid-working unloading machinery capable of discharging a 10,000-ton ship in twenty-four hours.

Owing to climatic conditions, it is necessary to stock ore during the summer season for use in the winter months. For this purpose there are ample stockyards equipped with electrically driven overhead travelling cranes of sufficient capacity to serve the furnaces without interruption or delay.

The works of the Dominion Iron and Steel Company at Sydney, and the Nova Scotia Steel and Coal Company at Sydney mines, consist of the following principal items:

Two Baum coal washers, capable of treating 4000 tons of coal daily; 150 non-recovery coke ovens with appliances for utilisation of surplus gas; 200 improved Otto-Hoffmann recovery coke ovens; 180 Koppers recovery coke ovens; some of these ovens are at present out of commission, but those in operation working together can produce 2500 to 3000 tons of coke daily. The recovery plants in connection with them are equipped for the production of tar, benzol, naphtha, sulphate of ammonia, &c. The surplus gas is used in other parts of the works for heating purposes. There are seven American standard blast-furnaces capable of an output of 2000 tons of pig iron daily.

At Sydney there are ten and at Sydney mines five basic open-hearth furnaces, three open-hearth mixers, two Bessemer converters, each 15 tons capacity, for use in connection with duplex process. These working together are capable of a daily output of 1600 tons of steel ingots.

All the steel produced is converted into saleable forms. The equipment available for the purpose consists of a 35in. blooming mill with gas-fired soaking pits; a 28in. rail mill with capacity for a daily output of 800 tons of heavy rails—60 lb. to 100 lb. per yard; a Morgan continuous wire rod mill, daily capacity 300 tons; a Morgan semi-continuous bar and rod mill, daily capacity 400 tons bars, 150 tons rods; a 16in. merchant bar mill, daily capacity 200 tons; a 110in. plate mill, daily capacity 450 tons sheared plate. There is also a Harmet fluid compression plant for production of compressed ingots up to 30 tons; and a complete plant for the manufacture of wire, wire fencing, nails, &c., and for galvanising.

The works are served by boiler plants using waste gases from blast-furnaces, and by electric power-houses using exhaust steam from mills and waste gases from blast-furnaces, generating upwards of 15,000 kilowatts.

There are well-equipped iron and brass foundries, and machine shops fully equal to all requirements for maintenance and repair of the whole of the works, and facilities for the manufacture of bricks.

The works at New Glasgow are mainly for the secondary processes, the production of merchant bars and light shapes, railway materials, such as splice bars, bolts, nuts and spikes; steel shafting, railway axles, and forgings of all kinds, including marine work of large dimensions.

There is also a very complete and modern car works for the manufacture of steel and composite freight cars of the various classes commonly used on Canadian railways.

This brief description will be sufficient to demonstrate the fact that in Eastern Canada and Newfoundland which for this purpose may be included as part of the same district, there are unlimited supplies of ore and coal and the nucleus of an iron and steel industry, which has a double promise of further development and success. It has access not only to a great part of the home market, but to the greater markets in other lands, which it can reach with the lowest possible expense by water transport.

It is not only of the greatest possible importance to Canada that this further development and success should be realised, but it is also desirable in the interest of the Empire.

Canada cannot take its proper place among the progressive nations of the world until, as was indicated in the earlier part of this paper, the resources of the country are utilised to the advantage of its people; until a halt is called in the importation of materials of prime necessity that can be produced at home, and that in their production will furnish a variety of employment and an opportunity to create and accumulate wealth.

The importance to the Empire of the development and maintenance of a vigorous iron and steel industry in Canada was sufficiently proved during the late war, when the Mother Country found it possible to procure very helpful supplies of steel for munitions in many forms, from billets to finished shells in great quantities, barbed wire, explosives, and other war materials, as well as temporary supplies of materials which previously had been supplied largely by Germany.

British traders who have connections with all the world might find it advisable to give greater consideration to the possibility of acquiring an interest in Canadian works and in the distribution of Canadian steel instead of materials produced by foreigners, who, as soon as opportunity offers, become their competitors, and who at times have been, and who again may be, their active enemies.

Canadians have already developed works which supply their own needs to a certain extent, and they have within their control resources, not only sufficient to provide the whole of their requirements, but to supply some part of the needs of other countries not so richly endowed.

Canadian steel is already known in many parts of the world. Canadian rails have been laid in India, South Africa, Australia, and even in England and Ireland. Canadian billets and rods and wire goods are well known in Japan and Australia.

What is needed is greater confidence in the future, more liberal investment of capital, larger and more varied production, and a more extensive system of distribution.

There exists in Canada at the present time an opportunity for the investment of capital that offers a fair prospect of adequate return, especially if it is backed up by the active co-operation of men who understand the business and are qualified by knowledge and experience to give to the iron and steel industry the vital qualities without which no large enterprise can succeed.

This paper has been prepared with the object of presenting as accurate an account as possible of the resources and condition of the iron and steel industry in Canada to the men of the Empire who are interested in the greatest of all industries, the development of the most abundant and widely distributed and the most useful resources of nature; the industry that takes coal and ores from the earth and converts them into the innumerable necessities and aids that the peoples of the world must have to maintain that civilisation of which the people of Great Britain and their kinsfolk everywhere are the chief defenders, and to which more than any other race they have been the foremost contributors.

Its appeal is to the men of Britain to join with the men of Canada to assist in developing the industry there. They have already been large contributors of capital, but for the most part their capital has not been followed by or joined with active personal co-operation. There is room in Canada for a great many men who will come with their money and settle down with Canadians, and join forces with them and work with them to build up an industry which Canadians have started, but in the further development of which they would welcome the support and assistance of their British kinsmen.

## North-Eastern Railway—Dock Improvement Schemes.

For various reasons, partly financial, and also it may be assumed from the desire to plan a co-ordinated scheme of improvement for the many docks which have now passed into the ownership of the London and North-Eastern Railway, no large scale new works will be put in hand in the immediate future. A minor scheme designed to improve the facilities for handling traffic at the Hartlepools, Blyth, Dunston, Tyne Dock, Sunderland, Middlesbrough, Hull, and Grimsby is now, however, in progress, and other works will be put in hand at an early date at some of the docks named. It should be stated that the need of providing additional facilities has been realised for some time past, and the works, either in hand or which have just been authorised, were planned before the issue of the report of the Port Facilities Committee at the Chamber of Shipping.

In the case of Hartlepool, for example, the committee recognised that an effective method of closing the harbour and the construction of quays would involve an expenditure of over £1,000,000, and a similar objection applies to the scheme for converting the Slake, a waste area in the centre of the existing dock system, into an additional dock. The North-Eastern Railway management has, therefore, decided to concentrate immediate attention on the provision of additional facilities for timber traffic. The work in prospect is the development for storage purposes of five acres on No. 4 Timber Pond site and the Carr House Estate. The land has been filled in and levelled and sidings constructed, and three new electric capstans are being installed at the Union Dock. It is hoped that these improvements will be completed before the opening of the timber season. The equipment of the coal dock which adjoins the Union Dock has been improved and better provision made at this dock for handling imports of iron ore.

At Sunderland the two new belt conveyors, in the installation of which the North-Eastern Railway has participated, will increase the capacity of the coal shipping plant by 1,000,000 tons a year. These conveyors, which have been supplied by Cowans, Sheldon and Co., Limited, are of the electrically-operated type, and designed for a maximum capacity of 750 tons per hour. The work carried out by the railway company was undertaken with the object of enabling the conveyors to operate at full capacity, and includes specially constructed sidings and approach roads laid out on the gravity principle. It has been necessary to construct a considerable length of embankment and retaining wall, and a new system of marshalling the loaded wagons for rapid discharge of coal into the hoppers which feed the belts has been introduced, as well as an improved method of shunting empties and of separating high capacity from smaller wagons during discharge to sidings. "Standage" for 2000 tons of coal has been provided in close proximity to the belts.

The scheme for Blyth includes new staithes at North Blyth and their equipment with gravity spouts and four new conveyors, as well as permanent way works. A modification is also being made in the railway connections to the existing staithes, with the object of increasing the rate at which coal can be shipped. A new electric sub-station and the necessary transmission system is to be provided at South Blyth.

The improvements elsewhere include new cargo and bunkering hoists at Tyne Dock—a new coal hoist at the Alexandra Dock, Grimsby, new steel floating gates to the Alexandra Dock, Hull, and additional sidings for fruit and vegetable traffic at the Riverside Quay, Hull.

At Middlesbrough the big improvement which is bound to come is either the construction of a new dock at an estimated cost of £1,800,000 or, as was suggested by the Port Facilities Committee, the provision of river wharves, capable of dealing with deep draught vessels, which would, it is estimated, cost £800,000. The objection to wharves is that their construction would have to be associated with a reclamation scheme on the north side of the river Tees to give protection to ships lying at the wharves. If the wharf scheme were approved the river-side quay could form the north wall of the new dock. The North-Eastern Railway Company—the owners of the existing dock at Middlesbrough—have had these schemes under review in past years, and a considerable area of land is now being prepared to meet the admitted need of dock extension.

The Atlas Works, Sheffield.—The firm of John Brown and Co. was founded in 1838 in Orchard-street, Sheffield, and rapidly made progress owing to the production of a conical buffer spring for railway vehicles. In 1855 Mr. Brown removed his Atlas Works, as he called them, to Savile-street, and a few years later took into partnership Mr. J. D. Ellis and Mr. W. Bragge. About this time the firm began the manufacture of an iron suitable for conversion into steel, and so laid the foundation of a new Sheffield industry. As early as 1863 the company had made such progress that it employed between 2000 and 3000 men, and in 1864 it was converted into a limited liability company with a nominal capital of one million pounds. For these few facts about the beginning of a firm which enjoys a world-wide reputation we are indebted to a handsome volume just issued by the firm. This volume tells us many interesting things about the company itself and its products, and it includes a number of excellent reproductions of charming water-colour drawings made by Mr. Herbert J. Finn. The first of these drawings is entitled "The River Don, Sheffield," and gives a good impression of that useful but forbidding stream. The other pictures represent operations in the works and, on the whole, catch the spirit of a steel works with as much effect but far less exercise of artistic licence than is usual amongst artists.

# British Wire-drawing and Wire-working Machinery.

No. III.—DIES.*

THE most critical part of a wire-drawing machine is, of course, the die, and upon its proper maintenance the success of the work entirely depends. There is, however, a total lack of precise information concerning the design of dies; and their production is a skilled handicraft guided more by experience than set rules. Thus one manufacturer will say that the reduction of the area of the wire in drawing by one-fifth is good practice, while another will claim an elongation of 50 per cent. in one pass. In any case, so many variable

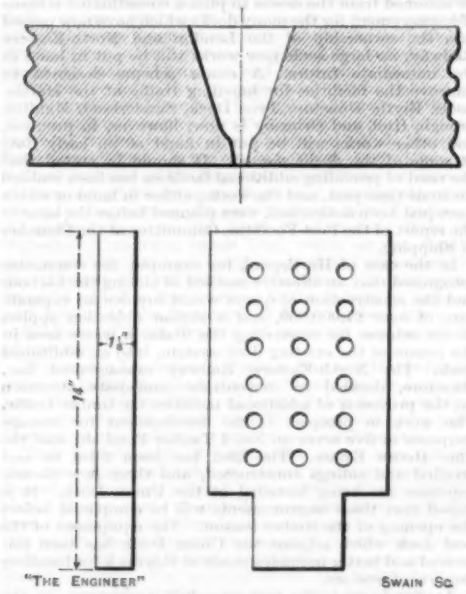



FIG. 16—BREAKING-DOWN DIE

conditions must be taken into consideration that it is difficult to generalise. It seems, however, that there should be some theoretical means of arriving at the best proportions of dies, as it is more or less agreed that the metal acts as a fluid in adapting itself to passage through the contracting hole, and the laws of fluid friction are well established.

Dies are generally made of steel, although cast iron is sometimes used in drawing copper, and diamond dies are employed in drawing long lengths of fine wires in continuous machines. For the heavy work of "breaking down"—the first operation on the wire rod—the die plate generally has from a dozen to eighteen holes pierced through it, and measures some 14in. by 6in. by 1¼in. to 1½in. thick. The holes, by the way, are all the same size, and are used in turn, as they wear too large to produce the required size of wire.

The shape of the holes is shown in Fig. 16, which is reproduced from a sketch made by a practical wire drawer, and differs somewhat from some illustrations which have been published. It will be noticed that the hole has two distinct zones, a comparatively short tapered section, in which the actual drawing is done, and a bell mouth leading up to it. The important point is that the bell mouth should have a well-rounded approach to the taper, so that its walls are quite clear of the entering wire. Without this precaution, there is a liability for the metal of the die to be drawn forward by the wire, and piled up in the throat, or "the hole is pulled out," to use the words of the wire drawer. The natural result is that the opening becomes too small and the wire is scrapped. The same effect may be produced with a properly shaped die if the wire be not thoroughly lubricated before it enters the die, but with that class of trouble we are not concerned at the moment.

The reason for the peculiar shape of the hole is probably to be found in the character of the material used in making the die and the method of hardening it. The material is almost universally plain carbon steel containing 1.5 to 2 per cent. of combined carbon. The steel is made by the crucible process and forged to size, but no attempt is made to harden the dies by tempering. Tempering would be very difficult in any case, and it would be almost impossible subsequently to maintain the size of the hole. As a consequence, the hole is roughly formed, and the metal is then hardened by hammering or "battering." This work-hardening can obviously be made to penetrate only a limited distance below the surface of the die, and this is probably why the bell mouth must be cleared well back from the bearing part of the hole, which is of a depth corresponding, approximately, to the thickness of the hardened metal.

The process of battering the die naturally closes up the hole to some extent—it is the means actually employed for renovating a worn die—and the hole is subsequently brought to exact size by driving in a tapered drift, or punch, to give it the usual trade term, which naturally further work-hardens the metal round the hole. The production of the punches is an art in itself, and is guided almost entirely by experience.

Some wire drawers like to have hollow-ground punches; that is to say, punches in which the taper gradually diminishes as the smaller end is approached, and these punches are ground by hand. In the majority of works, however, straight-tapered punches are used, and although many of them are still ground by hand, the operation is obviously one which can readily be performed on an automatic machine.

Such a machine, by Barron and Crowther, of Preston, is illustrated by Fig. 17. The punch is held in a self-centring chuck mounted on a spindle, which can be set at the proper angle, with regard to the base, to give the desired taper. A small abrasive wheel is mounted on a vertical spindle carried by a sliding head, and is traversed backwards and forwards along the punch by a gear-driven double-threaded screw. The grinding wheel is fed up to its work by hand.

In some few works the finishing of the hole is effected by a drilling or reamering process, which is said to be quicker, but it is plain to see that the final result cannot be so satisfactory. Neither is the surface of the hole so smooth, nor is it so hard, as is the case when it is drifted out.

When steel or hard brass wire is being drawn the wear of the die is considerable, and if the nominal size is to be kept within the limits now generally specified by purchasers, the dies have to be frequently battered and re-set with the punch. Up to recent times these operations have been carried out by the wire drawer himself, at his drawing block, and the cracked tables of many machines give evidence of the fact that they are used as anvils. The maintenance of the dies in this way naturally occupies a considerable proportion of the wire drawer's time, during which the machine is generally left standing, with a corresponding reduction in output, and there is a very marked tendency towards the adoption of tool-room principles in this direction. That is to say, the dies are prepared in a special department, and issued as required to the drawing benches. When they are worn they are then sent back for readjustment, just like the tools in an engineering works.

One of the most important items of equipment in the die shop is the battering machine, one type of which is illustrated in Figs. 18 and 19. It is the invention of Haley and Pinder, and is manufactured by George Crossley and Co., of Cleckheaton. It is, by the way, intended for the battering of the single-hole dies used after the first breaking-down operation on the wire.

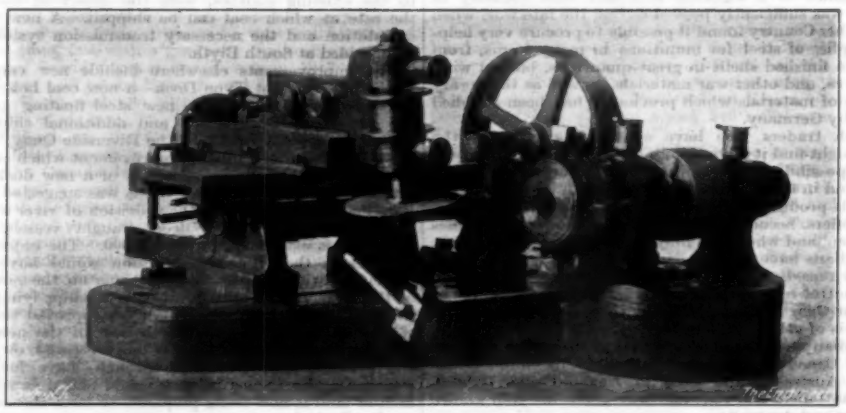


FIG. 17—PUNCH GRINDING MACHINE—BARRON AND CROWTHER

Referring to Fig. 19, it will be observed that the die A is mounted in a chuck at the head of a rotatable anvil B. The anvil is carried in a Y-shaped casting C, which can rock in bearings D in the main frame, and the position of the top of the die, with regard to the centre of the bearings, is such that as the Y casting is rocked the die will move through a circular path corresponding to the desired curvature of its surface. The rocking motion is imparted by the rack and pinion E, while the rotation of the anvil is effected by the ratchet F, working in conjunction with the skew gearing just below the die chuck.

Above the die there is a hammer G, driven through a bow spring and lever J from the excentric H on the main shaft. This excentric also operates the ratchet F. The rear fulcrum of the lever J can be raised or lowered by the hand lever K, and in this way the force of the hammer blows may be moderated to suit the requirements. It will readily be appreciated that by the combination of the several movements the whole of the top face of the die is battered evenly and to the proper curvature, far more quickly and thoroughly than is possible by hand. At the same time, the operation has the effect of drawing the metal of the die from the outer edges up towards the eye, so as to close the hole after it has been worn in service, and does not leave a hollow at the centre, as was the case with some early battering machines not fitted with the rocking motion.

With one or two machines of this type set up in a shop

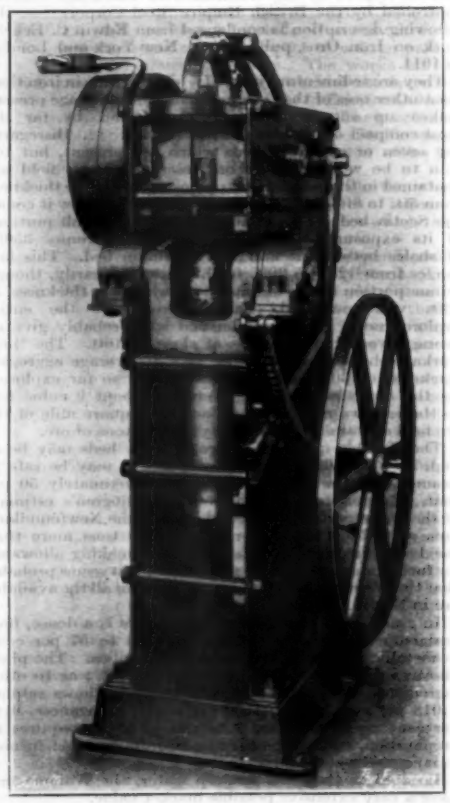


FIG. 18—DIE BATTERING MACHINE—G. CROSSLEY

specially provided for the purpose, the dies can be kept in much better order than is possible when they are battered promiscuously in the wire-drawing shop, while the arrangement reduces the number of skilled hands necessary. Incidentally, it forms an insurance against the breakage of the drawing machine tops, which too often are cracked through the punishment they get when the wire drawer batters his own dies on the machine.

Another important consideration is the saving in lost time which can be effected in the wire-drawing department by eliminating the maintenance of the dies from its routine. It is generally agreed that the actual productive time of a wire-drawing block operated under the old conditions is little, if any, more than one-half of the elapsed time. The remainder is taken up in preparing the machine, taking off the finished wire, and, most important, the dressing of the dies. If the dies are maintained by a separate department, and issued to the wire drawer ready for use as required, a much greater quantity of wire can be drawn in the same time.

Diamond dies, to which reference has already been made, are made in this country by only one firm, Thomas Bolton and Sons, Limited, of Richmond-road, Parkstone, Dorset, although a considerable number of continental made dies are used.

Diamond wire dies or draw-plates—see Fig. 20—consist of commercial diamonds drilled and mounted in brass or other metal cases, and are used in wire mills for drawing wire for electrical or other purposes. The great superiority over steel and other forms of draw-plates is accounted for by the hardness of the diamond, and its consequent freedom from wear,

* No. II. appeared July 25th, 1924.

which enables large quantities of wire of uniform gauge to be produced without changing the die.

In the manufacture of these dies the rough diamonds are first trimmed with diamond points, and are then drilled by means of small steel drills, fed with diamond powder, and made to oscillate mechanically for many hours. As only diamond can cut diamond, it is essential to use diamond powder to accomplish the work of boring. When pierced, the holes are shaped to suit the class of metal that is to be drawn. They are then polished to the required gauge, and adjusted to within one-ten-thousandth part of an inch, being

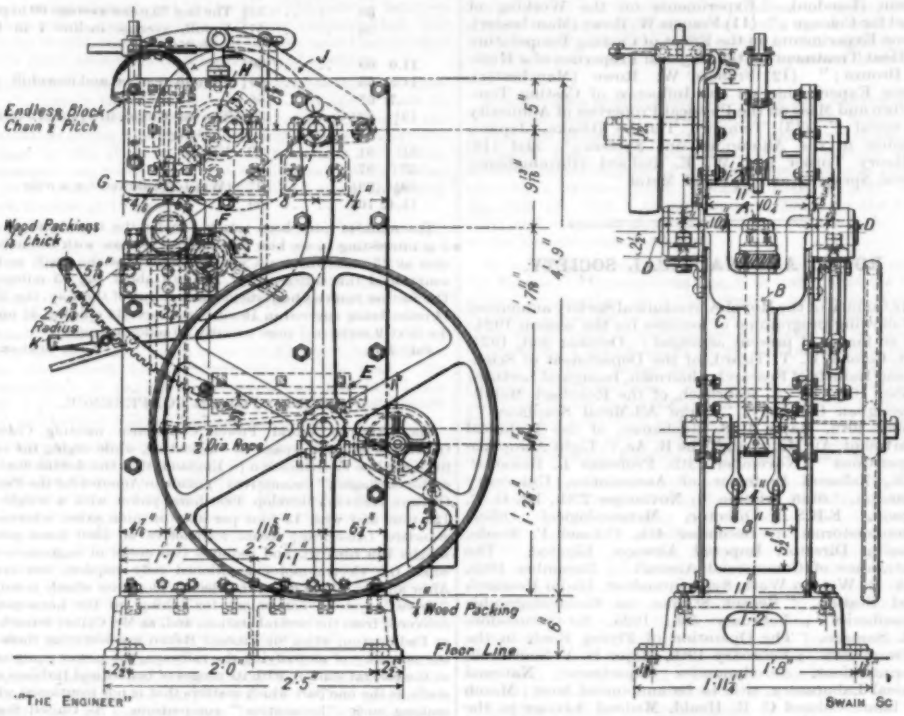



FIG. 19—HALEY AND PINDER DIE BATTERING MACHINE—G. CROSSLEY

finally mounted in brass cases a little larger than 1in. in diameter, in readiness for use.

The sizes of the holes range between about $^{1}/_{10}$in. and $^{4}/_{10000}$in., the smallest dies being used for drawing tungsten filaments for electrical lamps, and it is a cause of surprise to most people that so microscopical a hole as 0.0004in. can be accurately drilled through a diamond. The whole of the machinery used is electrically driven at high speed, and several machines are looked after by one employee.

It is interesting to note that the following classes of wires are drawn through diamonds: Telephone, telegraph, submarine cable, wireless aerial and coil,

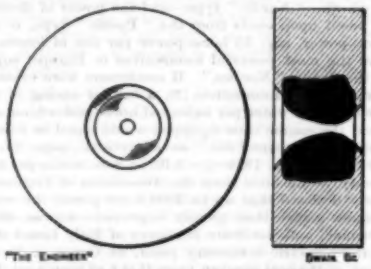



FIG. 20—DIAMOND DIE—T. BOLTON

tungsten filament, nickel chrome resistance wire, weaving wires for wire cloths, brush wire, scratch brush wire, bookbinding wire, pin and safety pin wires, platinum, gold and silver for the jewellery industry, gold and silver thread for braid, &c., surgical wire, music wires, carding wires for the textile trade, electric fuse wires, bronze spring wires and others.

## Electricity Supply in South Africa.

*(From a South African Contributor.)*

SOME few years ago it became recognised that the system being followed in South Africa with regard to the supply of electric light and power was not that best adapted to the extension of industries in the Union, and was certainly not the most economical. Practical expression was given to this conclusion by the passing of the Electricity Supply Act of 1922, by which the Electricity Supply Commission was brought into being, and as it actually started work in May, 1923, it must be conceded that no time was lost in giving effect to the expressed object of its creation—the supply and control of electrical energy in the Union. The tendency up to the passing of the Act had been for each local authority to possess its own generating station, but the trend of opinion is now strongly in favour of establishing super power stations generating the supply for large areas, and this policy may now be regarded as universally accepted. The promulgation of the Electricity Supply Act and the electrification of the railways foreshadow the abolition of many power stations here, for it is argued that energy can be generated much more economically in a large power station than in a number of small ones, and that with the safeguards provided in the Act the consumers are bound to benefit by the changing conditions.

The Commission has already in hand the provision or supervision of new supplies at Cape Town, Durban and Sabie, and will assume the control of the Colenso Power Station, now in course of erection in connection with the electrification of the 170 miles of the Glencoe–Maritzburg section of the South African Railways, when it is completed. It is also understood that the Commission has, or is just about to, come to terms with the Johannesburg Municipality in respect of the provision of the additional supply needed to meet the town's requirements, upon which the Town Council had contemplated the expenditure of £525,000.

### PRESENT POSITION.

Before dealing with what the Commission intends doing, it may not be amiss to examine the present position with regard to electrical undertakings within the Union of South Africa.

The only undertaking in South Africa which generates and sells electricity on a scale in anyway comparable with that of the world's largest undertakings is the Victoria Falls and Transvaal Power Company, Limited. With its subsidiary company, the Rand Mines Power Supply Company, Limited it supplies yearly about 1,000,000,000 kilowatt-hours from its four generating stations at Rosherville, Simmer Pan, Brakpan and Vereeniging, which have a total plant capacity of 220,000 kilowatts. Its consumers are mainly gold mines on the Witwatersrand, but some of the municipalities on the Rand also purchase a bulk supply from it, and there are sundry other consumers, such as factories, steel and ironworks at Vereeniging, &c. Before the days of the Victoria Falls Company nearly all the mines on the Rand generated their own electricity, and its principal use was for lighting purposes. The close association of some mines led to the establishment of central stations for such groups of mines, and to that class belong the stations of the Randfontein Estates (26,000 kilowatts), the East Rand Proprietary Mines (22,000 kilowatts), and the Kleinfontein Association (6000 kilowatts), which supply electricity both for light and power, and which, to some extent, also sell power to neighbouring municipalities and a few other consumers. The central power station—17,000 kilowatts—of the De Beers Company at Kimberley had a similar origin, and besides supplying the needs of the mining company itself, furnishes light and power to the extent of 3½ million units to the municipality and tramways of Kimberley. The other companies selling electricity all operate on a smaller scale and generate current mostly for their own use.

### MUNICIPAL ENTERPRISES.

The larger municipalities have generating plants of their own, both for town lighting, for selling energy to consumers for light and power, and, in the case of several of them, for running tramways. The installations with a rated capacity of over 1000 kilowatts are the following:—Johannesburg, 22,300 kilowatts; Durban, 12,000 kilowatts; Cape Town, 16,900 kilowatts; Port Elizabeth, 9000 kilowatts; Pretoria, 3500 kilowatts; Pietermaritzburg, 2200 kilowatts; East London, 1700 kilowatts; and Bloemfontein, 1650 kilowatts. There are also 33 other municipalities with plants of a capacity mostly under 200 kilowatts. Of other public undertakings of importance, mention should be made of the Cape Town Tramways Company, which uses 5½ million units per annum, which may be considered equivalent to a capacity of about 2500 kilowatts. The Port Elizabeth Tramway Company has a 900-kilowatt plant, and uses about 1,000,000 units per annum. The South African Railways and Harbours Administration has, at the present time, before electric traction is adopted on any of its sections, a large demand for electric power. Its workshops and harbour plants are completely electrified, while the lighting of these and of railway premises and the charging accumulators for coaches, give rise to a large demand. Over 20,000,000 units were consumed in 1922, and the major portion of this power was purchased from municipalities and transformed or converted as necessary. It produces its own electric power at Uitenhage, De Aar, Beaufort West, Towns River, and Standerton. The remaining producers of electric current in the Union are private persons and companies who generate their own electricity. The total number of plants is estimated at 1477, with a rated capacity of 115,171 kilowatts. The electric power for the Glencoe–Maritzburg section of the railway will be supplied from the Colenso power station, which is equipped with five turbo alternator sets, each designed to give continuously an output of 12,000 kilowatts.

### COMMISSION'S POLICY.

The policy of the Commission is to seek to establish power stations where an initial load of sufficient size to warrant the installation of high capacity generating plant with low production costs exists. There are at the present time three great groups of users, or potential users, of electrical energy in the Union—the mines of the Rand, the municipalities and the railways as the last named are electrified. The Commission hopes to add another group—manufacturing industries. At Colenso the running of the trains over the 170 miles of electrically-operated lines will serve to provide the load. For the new "super" station to be erected on the Witbank coalfield, the mines of the Rand will furnish the initial load. At Cape Town the electrification of the suburban and Simonstown lines, added to a growing demand on the part of the municipality's customers, will constitute abundant justification for the erection of an additional generating station, and a similar condition of affairs will obtain at Durban, where, already, the municipality finds it necessary to increase its power resources, to say nothing of the requirements of the railway when the electrification is continued up to that point.

Johannesburg's municipal needs are sufficiently indicated by its having prepared to embark on a £525,000 scheme.

Turning to details of the various schemes the Commission has in hand, the largest is the Witbank station to be put up by the Victoria Falls and Transvaal Power Company, for and on behalf of the Electricity Supply Commission, at a cost of about £1,000,000. This is to have an initial capacity of 60,000 kilowatts, consisting of three 20,000 kilowatt machines—maximum continuous rating. In future, extensions will be effected by the addition of 20,000 kilowatt units or units of even greater capacity. It is in fact confidently anticipated that the Witbank station will soon be extended to 100,000 kilowatts capacity. So far as the immediate purposes of the Witbank station are concerned, its supply will connect up with the Rand system at Brakpan, the transmission line to that point from the Witbank generating station having a length of 76 miles. Current will be transmitted at a pressure of about 130,000 volts.

### CAPE TOWN'S NEW STATION.

With regard to the Cape Town station the Commission has concluded an agreement with the Town Council, the main object of which is to link up the station which the Commission is to erect with the Corporation station, so that each can, when occasion requires, act as a stand-by to the other, and thus avoid duplication of spare plant. The Commission is planning to build a station with an initial capacity of 30,000 kilowatts. It was hoped that the contracts for the erection and equipment of the station would be placed early in July, and that an immediate start would then be made. It is expected that the station will take about two years to complete, and the cost is estimated at about £1,000,000, including the cost of the transmission lines and sub-station for supplying the South African Railway, which will also be provided by the Commission. With the arrangement entered into between the Commission and the Council, it is hoped that the Commission will be able to sell a bulk supply at a very much cheaper rate than would otherwise be possible, and

that the Corporation will also be able to sell current to its consumers at a cheaper rate, or, if it prefers, make a larger profit on its electricity undertaking for the relief of rates in other directions. With this enlarged scheme it is believed that the Cape Town industries should develop very considerably, as the anticipated reduction in the price of bulk current should be a great consideration.

The Commission has recently arrived at an understanding with the Durban Council, and there also the Commission will erect a new station, though details as to capacity and cost have not yet been made public. Eventually, of course, there will be a big demand from the railways at this point.

The Commission has under consideration a hydro-electric scheme for the Sabie district—Transvaal—where there are two gold-mining companies operating on a fairly considerable scale, and a number of smaller mines. The scheme would, however, be a very small one, certainly not exceeding 1500 kilowatts in capacity.

### INDUSTRIAL EXPANSION.

The Commission in all its schemes is bearing in mind the necessity of helping the country to develop industrially. The needs of the mines are an extremely valuable factor in providing the initial load so essential to the establishment of a great power station, like the Witbank for example, on such a scale that it can be run on the most economical lines, but the Commission looks further ahead in the direction of widespread industrial development.

With regard to the Witbank power station, the Commission has already in view the fact that the low rate at which it hopes to be able to sell power should be sufficient to induce many industries to be established, which, apart from such cheap power facilities, could not possibly be established in South Africa. It is thought that the cost of generating electrical energy at Witbank will be considerably less than one halfpenny per unit.

One of the industrial developments which it is hoped to see follow the provision of this cheap power is the manufacture of chemicals. It is believed that not only could South African requirements be met, but that a surplus for export could be manufactured. Products such as calcium carbide, cyanamide, sodium cyanide, should be very economically made. Electric furnaces for treating metals could also be greatly extended; the installations at Vereeniging and Dunswart could easily be enlarged, and their output greatly increased as a result of cheap and abundant electric power. Incidentally, this should stimulate the South African steel industry, especially as regards high grade steels, because there is an abundance of the essential ingredients to be obtained in the country—chromium, vanadium, and a certain quantity of tungsten.

## The Institute of Metals.

THE autumn meeting of the Institute of Metals will be held in London from September 8th to 11th, and in connection with it the following programme has been arranged:—On Monday, September 8th, the office of the hon. local secretary, Mr. A. H. Mundey, will be open at the Institution of Mechanical Engineers, Storey's-gate, Westminster, from 2.30 p.m. to 8 p.m., for the issue of tickets, badges, &c., and for general information. In the evening at eight o'clock the third annual autumn lecture will be delivered by Mr. W. M. Corse, S.B., of the National Research Council, Washington, D.C., his subject being "Recent Developments in Non-ferrous Metallurgy in the United States, with Special Reference to Nickel and Aluminium-bronze." On the Tuesday at 10 a.m. there will be a general meeting of members in the Hall of the Institution of Mechanical Engineers, Storey's-gate, Westminster, when, after the transaction of certain business, a selection of papers will be presented in abstract and discussed. The meeting will be adjourned at 12.40 p.m. until the following day. In the afternoon, after luncheon at the Connaught Rooms, Great Queen-street, W.C. 2, a visit will be paid to the British Empire Exhibition, where the party will be entertained to tea at the Regent Restaurant by the local committee.

On the Wednesday at 10 a.m. there will be a general meeting of members in the Hall of the Institution of Mechanical Engineers, when a further selection of papers will be presented in abstract and discussed. In the afternoon there will be alternative visits to:—(1) The Royal Arsenal, Woolwich; (2) the Royal Mint, Tower Hill; (3) Messrs. Dewrance and Co., Great Dover-street; (4) Messrs. Fry's Metal Foundry, Blackfriars; (5) J. Stone and Co., Limited, Charlton Works; and (6) the United Glass Bottle Manufacturers (Charlton), Limited. At 8 p.m. a reception will be held at the National Physical Laboratory, Teddington, by invitation of the Director and Executive Committee of the Laboratory and the local committee of the Institute of Metals.

On the Thursday there will be a trip to Windsor, starting from Waterloo Station at 9.20 a.m., by train for Hampton Court, and thence by launch.

The following communications are expected to be submitted for consideration at the meeting:—(1) Robert J. Anderson (Boston, Mass.) and Everett G. Fahlman (Cleveland, O.), "A Method for Measuring Internal Stress in Brass Tubes;" (2) D. H. Andrews and Professor John Johnston, D.Sc. (New Haven, Conn.), "The Application of the Ideal Solubility Curve to the Interpretation of Equilibrium Diagrams in Metal Systems;" (3) Guy D. Bengough and R. May (London), "Seventh Report to the Corrosion Research Committee of the Institute of Metals;" (4) E. H. Dix, jun., and Lieut. A. J. Lyon (Dayton, O.), "Comparative Results on Copper-silicon-aluminium and other Aluminium Alloys as Obtained on Separately Cast Specimens and Specimens Cut from a Crank Case Casting;" (5) D. M. Fairlie and G. B. Brook (Kinlochleven), "The Determination of Sodium in Aluminium;" (6) R. Genders (Woolwich), "The Extrusion of Brass Rod by the Inverted Process;" (7) D. Hanson and Grace W. Ford (Teddington), "Investigation of the Effects of Impurities on Copper: Part II., The Effect of Iron on Copper;" (8) Douglas H. Ingall (Wednesbury), "The Relationship between Tensile Strength, Temperature and Cold Work in Some Pure Metals and Single Solid Solutions;" (9) H. Moore, D.Sc., Ph.D. (Woolwich), "On the Effect of Progressive Cold Rolling on the Brinell Hardness of Copper;" (10) Sir Thomas K. Rose, D.Sc., and J. H. Watson (London), "Experiments on the Working of Nickel for Coinage;" (11) Francis W. Rowe (Manchester), "Some Experiments on the Effect of Casting Temperature and Heat Treatment on the Physical Properties of a High-tin Bronze;" (12) Francis W. Rowe (Manchester), "Some Experiments on the Influence of Casting Temperature and Mass on the Physical Properties of Admiralty Gun-metal;" (13) Tomojiro Tanabe (Osaka, Japan), "Studies in the Aluminium-zinc System;" and (14) T. Henry Turner and W. E. Ballard (Birmingham), "Metal Spraying and Sprayed Metal."

## ROYAL AERONAUTICAL SOCIETY.

THE Council of the Royal Aeronautical Society announces the following programme of lectures for the session 1924–1925 so far as at present arranged:—October 2nd, 1924, Lieut.-Colonel H. T. Tizard, of the Department of Scientific and Industrial Research, chairman, Inaugural Lecture; October 16th, Dr A. Rohrbach, of the Rohrbach Metall-Flugzeugbau Company, "Large All-Metal Seaplanes"; October 30th, Major J. S. Buchanan, of the Technical Department, Air Ministry, "The R. Ae. C. Light Aeroplane Competitions"; November 13th, Professor L. Bairstow, F.R.S., Zaharoff Professor of Aeronautics, University of London, "Skin Friction"; November 27th, Dr. G. C. Simpson, F.R.S., Director, Meteorological Office, "Thunderstorms"; December 4th, Colonel F. Searle, Managing Director, Imperial Airways, Limited, "The Maintenance of Commercial Aircraft"; December 18th, Mr. A. R. Watson Watt, Superintendent, Radio Research Board Station, "Recent Studies on Radiotelegraphic Atmospherics"; February 5th, 1925, Air-Commodore C. R. Samson, "The Operation of Flying Boats in the Mediterranean"; February 19th, Major R. V. Southwell, Superintendent, Aerodynamics Department, National Physical Laboratory, title to be announced later; March 5th, Lieut.-Colonel C. B. Heald, Medical Adviser to the Director of Civil Aviation, Air Ministry, "Some Medical Aspects of Air Transport"; and March 26th, Dr. Eckener, Managing Director, Zeppelin Airship Company, "Modern Zeppelin Airships."

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### TRAIN PERFORMANCES ON MIDLAND RAILWAY.

SIR,—It is a remarkable fact that for really smart travelling the Midland section of the L.M.S. still gives the best examples. Recently, it was my good fortune to take the log of a really good run, and as the readers of THE ENGINEER are always interested in locomotive performances, the information is passed on.

The run was made by a Manchester to St. Pancras express, leaving Derby at 6.4 p.m. for Leicester. The 27¼ miles to the milepost 100¼ was done in 32 min., but it was after Leicester that better speeds were achieved. The engine was No. 1043, one of the standard outside cylinder 4–4–0 Derby-built locomotives, with eight bogie carriages, including one dining car, so that probably as the train was well filled the load behind the tender would be about 275 tons. In the following table the names of stations are only an indication of the place, for the timing is for the respective distance as shown by the milepost.

| Time. | | Milepost. | |
|---|---|---|---|
| 6.44 | .. .. | 100 | |
| 7.2½ | .. .. | 84 | (Market Harborough) |
| 7.7 | .. .. | 80 | |
| 7.14 | .. .. | 73 | |
| 7.15 | .. .. | 72 | (Kettering) |
| 7.19½ | .. .. | 67 | |
| 7.22½ | .. .. | 63½ | |
| 7.24 | .. .. | 62 | |
| 7.29 | .. .. | 57 | At this point a full mile was run in 45 sec. |
| 7.31 | .. .. | 55 | |
| 7.33½ | .. .. | 53 | |
| 34½ | .. .. | 51 | (Bedford) |
| 7.37½ | .. .. | 48 | Estimated about 8 min. before time here |
| 7.40 | .. .. | 45½ | |
| 7.43 | .. .. | 43 | |
| 7.45 | .. .. | 41 | |
| 7.49 | .. .. | 38 | |
| 7.55 | .. .. | 34 | |
| 7.58 | .. .. | 30 | (Luton) As still before time, evidently engine no longer pushed |
| 8.3 | .. .. | 25 | |
| 8.6½ | .. .. | 21 | |
| 8.9 | .. .. | 18 | |
| 8.12 | .. .. | 15 | |
| 8.17 | .. .. | 10 | |
| 8.19 | .. .. | 7½ | |
| 8.22½ | .. .. | 4 | |
| 8.29½ | .. .. | 0 | Actual stopping time, 5½ min. before due |

It will be noticed that just before as well as after Luton and at Bedford the speed was nearly 80 miles per hour and at several other points it was above 70 miles per hour, whilst the average was always over 60 miles per hour. This run from Leicester could always be done more quickly than timed, for on another occasion one of the Scotch expresses to London arrived at Leicester 26 min. late, but made up 16 min. to London, travelling quite long stretches at 80 miles per hour.

On another trip with a similar engine to the 1043 the 9.50 from London to Glasgow gave some good running, but there were several checks for permanent way repairs that rather spoilt the actual figures, but these were as follows:—

| Time. | | Milepost. | |
|---|---|---|---|
| 9.50 | .. .. | 0 | |
| 10.10 | .. .. | 14 | |
| 15½ | .. .. | 20 | |
| 22½ | .. .. | 25 | To here average 47 m.p.h. |
| 33 | .. .. | 35½ | Slowed at Luton for half mile |
| 37 | .. .. | 40 | Slowed at Flitwick for 1 mile |
| 45 | .. .. | 47 | |
| 50 | .. .. | 52½ | The last 25 miles average 60 m.p.h. |
| 56 | .. .. | 57½ | Uphill, average incline 1 in 125 to 250 |
| 11.0 | 60 .. .. | 60¼ | |
| 11.5 | 65 .. .. | 64½ | Summit reached and downhill |
| .7 | 67 .. .. | 66 | |
| 13½ | 73½ .. .. | 74 | The last 8 miles in 6½ min., average 78 m.p.h. |
| 31 | 91 .. .. | 89 | Uphill |
| 37 | 97 .. .. | 95 | |
| 39½ | 99½ .. .. | 97 | (Wigston), slowed for a mile |
| 11.42 | 102 .. .. | 99 | |

The minutes have been totalled under the time heading, as it is interesting to see how the minutes see-saw with the miles; thus at 25 miles the train was 22½ min. past the hour, and it maintained this difference of 2½ until about the 55 milepost. The further run to Chesterfield was not out of the way, the first 14 miles being covered in 16 min., the next 32 miles in 32 min., the next 9 miles in 7 min.—nearly 80 miles average.

July 28th. S. S. SELLAR.

### WORLD POWER CONFERENCE.

SIR,—At the World Power Conference meeting, Colonel O'Brien is reported—page 73—as stating, while urging the case for main-line electrification in England, that the double electric motor carriages ("locomotives") made in America for the Paris-Orleans Railways develop 3000 horse-power with a weight of 120 tons and with 13 tons per axle on nine axles, whereas a standard (American) steam locomotive of 2800 horse-power weighs 240 tons (!), and requires two crews of enginemen (!), while the electric-motor mentioned only requires one crew. After all is said and done, the electric motor on wheels is only a "drive" system, convenient for taking up the horse-power delivered from the central station, and, as Mr. Collett remarked, at Paddington, when Sir Vincent Raven was lecturing there on the necessity of electrifying the railways, the power equipment at the central station, with its ranges of boilers and turbines and staffs, is the one part which matters that is not mentioned when making such "locomotive" comparisons. As United States locomotives commonly weigh 50 per cent. more than continental locomotives—compound, of course—per horse-power developed, it would have been more just to have quoted French practice. Thus, with 90 tons weight, the P.L.M. "Pacific" compounds develop over 2500 horse-power, and maintain continuously 27 horse-power per ton of locomotive for any distance up-grade of 1–200, with 650 car tons, as against 25 horse-power, maximum, by the P. and O. electric locomotors. With 600-ton trains, run on level lines at 70 miles per hour, the P.L.M. compounds—which have only two 17½in. by 25.5in. cylinders, supplied with boiler steam at 52 per cent. cut-off—consume 13 lb. steam per indicated horse-power-hour, and require only two enginemen. They have only six axles, against nine in the electro-locomotor, which latter "could haul 500 tons at 65–70 miles per hour."

But the limit of locomotive power is not yet reached for two enginemen, and this is about 4000 horse-power compound, or 2700 horse-power simple. Now, the P.L.M. is using eight large coupled wheels—"Nordic" type—and the power of these new engines, based upon cards from the "Pacific" type, is about 3400 horse-power, say, 35 horse-power per ton of locomotive. These are the most powerful locomotives in Europe, superior even to the Saxon "Nordics." If condensers were eventually found practical for locomotives (?), a further saving of 25 to 30 per cent. in the water per indicated horse-power-hour would result, and the engine thus equipped would equal in efficiency the compound "locomobiles," as advertised—page 24, THE ENGINEER, July 18th, 1924—(= 8 lb. to 9 lb. steam per horse-power-hour). Some time since the Association of Engineers of Manchester declared that up to 3000 horse-power the reciprocating engine—since then greatly improved—was as efficient as the turbine, and the State Railways of Italy found that a steam-turbine electric stationary plant, at Genoa, only saved 16 per cent. of the coal in seven years that had been used during seven years previously to work the same traffic by an odd medley of all sorts of steam locomotives, old and new. With greatly improved designs, the compound reciprocating locomotive beats the turbine at train-head; but is, in its turn, hopelessly beaten by the Diesel motor on the B.Th.U. consumption basis—the only competitor against compounds of 12 lb. of steam per indicated horse-power hour.

July 26th. CHARLES R. KING.

THE HOUSE OF CARMICHAEL.—We have before us a brochure which bears the title given above and which has been recently issued by James Carmichael and Co., Limited, of the Ward Foundry, Dundee. In part the volume is a catalogue of the varied products of the company, and in part it is a history of a famous firm. James Carmichael was born in 1776 and served his time as a millwright. In 1810 his brother Charles, who had received a similar training, suggested that they should take up the manufacture of steam engines. Agreement was soon reached, and the firm entered on its career as Messrs. J. and C. Carmichael. James was a man with considerable inventive talent, and when a repeat order for a twin ferry boat for the Tay was secured in 1823 he set about devising an engine reversing gear which could be readily operated from the deck. It was fitted to the ferry steamer George IV. and proved perfectly successful. The gear is fully described and illustrated in the brochure. A few years later the fan blower for forges and furnaces was introduced with remarkable success, and the invention was freely and liberally given to the trade. In 1833 J. and C. Carmichael built two locomotives for the Dundee and Newtyle Railway. They were named the Earl of Airlie and the Lord Wharncliffe. They had vertical cylinders, one at each side of the boiler, which, through return connecting-rods and bell cranks, drove the driving wheels. Another important invention was a planing, shaping and boring machine. Charles Carmichael died in 1843 and James some ten years later. Their sons carried on the business under the name of James Carmichael and Co., which it bears to this day.

## Railway Matters.

THE extension from Hendon to Edgware of the London Electric Railways is to be opened on the 18th inst.

WE learn that the Hull Corporation Tramways Committee has accepted the tender of Bolckow, Vaughan and Co., Limited, Middlesbrough, for 1500 tons of rails at a cost of £17,936. The German tender was £3000 less, and the Belgian tender £2700 cheaper. The Committee felt that the work should be kept in this country.

A DEPUTATION recently waited upon the Minister of Transport and the Great Western Railway Company to urge, as relief for the unemployed, the building of a railway between Abergavenny and Talyllyn. It was claimed that this railway would make the spas of Builth and Llandrindod Wells more accessible to a large area of country.

THE new issue of "Bradshaw" indicates some interesting changes in the train services over and above those to which the companies drew attention. One of them is the restoration of the pre-war summer day service to and from Belfast by the shortest route, *viâ* Stranraer and Larne. Passengers can leave Euston at 10 a.m. and reach Belfast at 10.35 p.m., or leaving Belfast at 9.5 a.m., they may reach Euston at 10 p.m.

THE interim dividends of the London, Midland and Scottish, the Great Western and the Southern Railways are at the same rate as a year ago. In view of the ten days' stoppage owing to the enginemen's strike last January and the evil consequences of the dockers' strike later, coupled with the complaints as to the slow revival of trade, these announcements are very gratifying. They would not have been made were the directors not satisfied with the outlook for the remainder of the year. The Metropolitan is paying 2 per cent., as against 1¼ per cent. a year ago. That company is reaping great benefit from the British Empire Exhibition traffic.

THE first railway accident in Scotland for seven and a-half years in which passengers have lost their lives occurred at the London and North-Eastern Company's station at Haymarket, Edinburgh, on Monday evening last. A down passenger train stood in the station waiting to make a connection with an up train when it was run into by a following down train. Four passengers in the standing train were killed. On the previous Friday evening there was a less serious accident at Lime-street Station, Liverpool. A light engine fouled the path of an incoming passenger train, and in the collision that resulted several passengers were slightly hurt.

A FURTHER question as to overcrowding on the trains between Glasgow and Euston and St. Pancras was addressed to Mr. Gosling on the 8th ult. That gentleman replied that an analysis made by the railway company showed that during the week ending June 21st, under 9000 third-class passengers were conveyed and over 12,000 third-class seats provided. The company agreed, however, that on certain trains there was insufficient accommodation. At the present time a good deal of difficulty is occasioned by the additional traffic to and from Wembley, which is of an erractic nature, and also by the demands on the rolling stock entailed by the same traffic.

IN Major Hall's report on the collision of February 9th at Eastwood between a passenger train and some wagons and a brake van which had become separated from their train, it was said that one of the wagons where the division took place had its draw hook nibbed, but the hook of the other wagon had not. The nibbing referred to was introduced at the beginning of 1911, and consists of providing a lip on the inner side of the slot in which the coupling from the adjoining wagon is placed. This lip makes it less easy for the coupling, when the wagons "buffer up," to rise and be lifted out of the slot. The nibbing is done in the hooks of all new wagons and in all replacements of hooks. It is also a requirement for privately-owned wagons.

THE Chelsea Chamber of Commerce has suggested to the London Electric Railways Company that the latter should build a tube railway from the Great Northern, Piccadilly, and Brompton at South Kensington to the south side of the Thames. The company has replied that it is unable to entertain the proposal at present. It has frequently struck us that there is great need for underground communication from South Kensington, through Chelsea and Walham Green, under the Thames near Bishop's Park, and thence through North Putney to the Southern Railway at Barnes and so to Richmond. The Southern Railway would, of course, oppose this connection, as it would rob that company of the mileage from Ravenscourt Park.

THE Ministry of Transport's railway statistics for April have recently been issued as a Stationery Office publication. They show that, when compared with April, 1923, there was an increase of 2 per cent. in the number of passengers conveyed, and an increase of 12.7 per cent. in the receipts. The Ministry suggests that this apparent paradox is explained by the fact that the week before Easter fell in April this year instead of in March, as in 1923. To carry this increase of 2 per cent. in the number of passengers, there was an increase of 5.3 per cent. in the coaching train miles, no doubt because of the greater distance the passengers journeyed. The freight tonnage increased by 0.7 per cent., but, owing to reductions in rates made in May and August, the receipts fell by 7.4 per cent.

THE new rolling-stock provided for the tube railways have no inside handles on the doors, and therefore there can be no accidents from the doors being opened whilst the train is running. The doors are closed by a pneumatic device operated by the rear conductor, and the train cannot start until all the doors are closed. This is another safeguard. Judging by a question recently addressed to the Minister of Transport, these provisions are not universally recognised. Mr. Gosling, however, replied that the railway company had stated that there was no record of any trouble having arisen in connection with the working of these doors. We would add that it must not be overlooked that this arrangement renders it unnecessary for any gatemen to be on the trains, as the conductor opens and closes all the doors from his compartment. This, possibly, is not to the men's liking.

## Notes and Memoranda.

A RELAY has been developed in America which discriminates between short circuits and heavy overloads, even though the short-circuit setting may be smaller than the overload. For automatically restoring this short-circuited feeder to service after the arc which may have caused it has broken a resistance-measuring relay operates to re-close the breaker.

REPLYING to a question in the House of Commons recently the Secretary for Mines (Mr. Shinwell) said he was aware that experiments had been made in the United States in the use of wireless as a means of saving life in mining disasters. Experimental work on a small scale had also been undertaken privately in this country, and his Department was watching developments both here and abroad.

A CONCRETE bridge span, 46ft. long and weighing 168 tons, was recently removed bodily, in Los Angeles, to permit the passage of a dredger to the west channel of Alamitos Bay. The span had been purposely made separate from the rest of the structure, and was held in place by a bitumen joint. A barge, 104ft. by 30ft. lifted the span off, with a submergence of 23in., on the rising tide, and returned it to its seatings on the ebb. The whole job occupied five hours.

IN a report on electrification in Sweden, drawn up by the Minister of Communications, it is stated that the total annual production of hydro-electric power in Sweden normally amounts to about 2800 million kilowatt-hours, while the Swedish waterfalls are estimated to be capable of producing a maximum of 35,000 million kilowatt-hours, so that less than 10 per cent. of the available power has hitherto been exploited. The continued exploitation of water power for industrial purposes, however, cannot be expected to reduce to any considerable extent Sweden's need for fuel, as the development of industry will simultaneously increase the need for fuel for heating, &c.

IN a paper read before the second annual meeting of the Institution of Chemical Engineers Mr. Eustace A. Alliott dealt with self-balancing centrifugals. His conclusions may be summarised as follows:—Precession in self-balancing centrifugals may be minimised by short spindles, when the basket inertia is preponderant about the spindle rather than the buffer, and by adequate buffer control and friction. Whirling is minimised by long spindles, weak buffer control, friction in reason, and adequate acceleration. Acceleration is limited by power consumption. Friction is limited by power consumption, wear and tear, and freedom from vibration. Basket shapes are limited by loading requirements and necessity for ease in loading evenly. A further point brought out was that the critical speed is the most important of the calculable factors relating to a flexibly supported machine.

A FURTHER stage in the development of the Cast Iron Research Association was reached a few days ago, when the Association formally took possession of its own laboratories. These are situated in Guildford-street, Birmingham, and are equipped for the conduct of chemical analyses and general metallurgical and heat treatment work. The research programme includes important investigations on erosion and corrosion-resisting cast irons; moulding sands; graphitisation; heat-resisting cast iron; the production of malleable cast iron; cupola practice; cast irons for electrical and magnetic purposes; measurement of melting and pouring temperatures; the fundamental properties of cast iron; standardisation of test bars, materials, and methods; facing sands and blackings, and cast iron to resist abrasive wear. Recent new members include the Powell Duffryn Steam Coal Company, Limited, Glamorgan.

THE variation of torque during the revolution of a motor-driven air compressor causes considerable pulsations of current, which are liable, if excessive, to cause flickering of lights on the circuit and oscillations in the motor, which may even cause it to fall out of step easily or to break down ultimately owing to continually varying forces, as well as producing oscillations in other motors on the circuit. According to *Science Abstracts*, the Electric Power Club in America has therefore made a rule limiting such fluctuations to 66 per cent. of the full-load current. Although these pulsatioas can be lessened by the additional moment of inertia due to the fly-wheel of the compressor, the matter is not so simple as it would appear, as there may be widely different values of the moment of inertia that may produce the same pulsation and a value between them at which it is considerably worse, owing to resonance with the natural period of oscillation of the set.

IT is reported in the *Electrical Review* that Dr. J. H. Hammond, jun., has developed a system of radio transmission which is claimed to achieve at one stroke three very important and much-sought-after results. First, Dr. Hammond claims to have solved the problem of multiplex transmission through the ether. For instance, in a test carried out in Rome, a concert and a lecture were both transmitted simultaneously from the same aerial and on the same wave length, and were picked up separately on the same receiving aerial, while another station transmitting on exactly the same wave length was unable to cause any interference. The latter point is quoted as an illustration of the second result achieved by the invention, namely, immunity from jamming. Thirdly, the system is said to afford privacy of communication, for it appears that the waves sent out by Dr. Hammond's transmitter are virtually immune from interception by unauthorised stations. As to the means by which these results are claimed to be secured, Dr. Hammond explained that his method was to produce a secondary modulation in the radiated waves, and thus to form a characteristic wave that would only yield intelligible signals—either telegraphic or telephonic—to a receiver acquainted with its characteristic and having the necessary apparatus to detect it. At the same time it is necessary by pre-arrangement for the receiving station to know exactly what factor to use in order to rectify the wave. The multiplex result arises from the fact that more than one—perhaps even four—different characteristics can be applied simultaneously to the same wave, each conveying a different message.

## Miscellanea.

A COMPANY has been formed in Milan to manufacture electrolytic iron in Italy.

ON July 14th there were 1,026,000 registered unemployed in Great Britain, 1449 more than on July 7th. The total included 781,100 men and 187,300 women.

THE Australian Federal Government Naval Engineering Staff is said to have prepared and submitted to the Cabinet plans for a floating dock, 860ft. long and 180ft. wide, and capable of receiving vessels drawing 40ft. If the plans are accepted, both of Australia's new cruisers will be built in England, and the money thus saved will cover the expenditure of the dock.

AT a recent special meeting of Greenock Corporation it was resolved to apply to the Electricity Commissioners for a special order to extend the area for the supply of electricity so as to include portions of Port-Glasgow and Gourock that are beyond the area at present authorised, and also portions of the perishes of Greenock and Inverkip not at present included in the present area.

A COMPANY for carrying out research on fuels has been formed in France under the title of Société Nationale de Recherches sur le Traitement des Combustibles. The registered offices are at 35, Rue Saint-Dominique, Paris. The French Government, the Comité Centrale des Houillères, the Comité des Forges de France, and various other public associations are represented on the board of directors.

THE Secretary for Mines gives notice that a type of breathing apparatus known as the Draeger No. 2—1921 model—apparatus, manufactured by Messrs. H. and B. Draeger, Draegerwerk, Luebeck, Germany, has passed the official tests, and that the Board of Trade has decided to approve this type of apparatus. The approving order containing a specification and drawings of the apparatus is in preparation, and will be published shortly.

THE Greenock Harbour Trust has agreed to proceed with the scheme for the extension of the Garvel Graving Dock. At a special meeting it was reported that Lithgows, Limited, shipbuilders, Port Glasgow, had offered £25,000, and the Government Unemployment Grants Committee would contribute £11,000 conditional upon the work proceeding at once. The dock is to be widened to 65ft., and deepened by 4ft., at an estimated cost of £67,000.

WHEN the Cunard liner Franconia was dry-docked at Southampton on Friday last it was found that the bottom of the ship was badly scraped as the result of her fouling an uncharted rock during her recent voyage to Norway. Some of the oil bunker seams on the port side were started, and during the docking a considerable amount of oil fuel ran into the dock, causing some inconvenience. Happily most of the oil was recovered. Repairs to the vessel are to be made at Southampton.

THE Board of Trade *Journal* of July 31st states that H.M. Trade Commissioner at Sydney, has forwarded copies of the recently revised Electrical Wiring Rules of the Institution of Engineers, Australia. These rules are applicable to all States of the Commonwealth, with the exception of Victoria, where the rules of the State Electricity Commission have statutory powers. The difference between the two sets of rules are not, however, of very great moment. The rules mentioned above may be consulted by interested British firms on application to the Department of Overseas Trade (Room 52), 35, Old Queen-street, London, S.W. 1.

DOUBTS having been expressed as to whether the excellent train-ferry service now running between Harwich and Zeebrugge will be able to maintain their regular journeys during the winter, it is interesting to note that the boat which made the crossing during the tremendous heavy seas on July 17th was only 1½ hours late. We are informed by the London and North-Eastern Railway Company that the vessel went to sea and steamed across in the teeth of the great gale reported from the Belgian coast when 26 Belgian fishing boats foundered. The captain of the train ferry, on being interviewed, stated that no seas were shipped on the rail deck, and the cargo in open trucks was not damaged.

THE White Star liner Arabic, 16,786 tons, which has during the last three years been on the Mediterranean route, will enter the company's service between Southampton, Cherbourg, Halifax and New York on August 18th. To meet the requirements of this trade, the steamer has been converted into a cabin and third-class carrier—having previously accommodated three classes—and will have room for 500 in the former and 1200 in the latter department. The White Star fleet engaged in Transatlantic trade now includes no less than eight intermediate liners of this type. The Arabic is 612ft. long, with a beam of 70ft. In her new sphere, she will be associated with the Pittsburgh, 16,322 tons, and these two steamers will maintain a regular service between the above-named ports.

WE learn from the *Electrical Times* that the London County Council Highways Committee recommends that Parliamentary authority should be sought next session for the construction of a tramway from Southend Village *viâ* Downham to High-street, Eltham. This is a modification of the scheme which was approved by the Council in November last for inclusion in the Tramways and Improvements Bill of the present session. The tramway will cross Downham by a road to be constructed by the Council in connection with the development of the estate. The total estimated capital cost of the proposal is £303,735, of which £261,235 is in respect of tramway construction and £42,500 for necessary widenings. The estimated surplus on working is £4619, but after allowing for debt charges—£18,891—other than those in respect of improvements this is converted into an estimated deficiency of £14,272. The annual deficiency is £9800 more than was estimated last year, the difference being due partly to the higher capital cost of the new scheme, but mainly to the lower estimated income. On further consideration the committee has come to the conclusion that it would not be advisable to seek powers next session to operate motor omnibus services in connection with the Council's tramways.

# DEEPENING THE INNER HARBOUR AT HOLYHEAD

(*For description see page* 137)

FIG. 1—BROKEN ROCK PRIOR TO REMOVAL

FIG. 2—CHANNEL AFTER REMOVAL OF ROCK

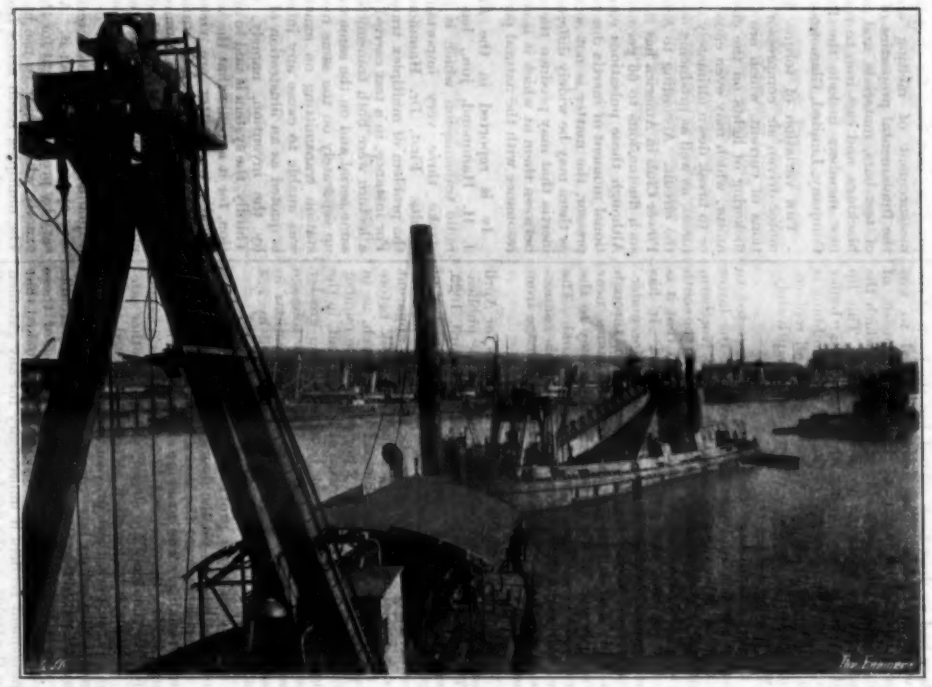


FIG. 3—ROCK BREAKING AND DREDGING PLANT AT WORK

FIG. 4—HOPPER LOADED WITH ROCK

**AGENTS ABROAD FOR THE SALE OF**

## The Engineer

BUENOS AIRES.—Mitchell's Book Store, 576, Cangallo.
CHINA.—Kelly and Walsh, Limited, Shanghai and Hong Kong.
EGYPT.—Cairo Express Agency, near Shepheard's Hotel, Cairo.
FRANCE.—Boyveau and Chevillet, Rue de la Banque, Paris.
Chapelot and Cie., 136, Bld. St. Germain, Paris.
BELGIUM.—W. H. Smith and Son, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.
INDIA.—A. I. Combridge and Co., Bombay; Thacker and Co., Limited, Bombay; Thacker, Spink and Co., Calcutta.
ITALY.—Maglioni and Strini, 307, Corso, Rome; Fratelli Treves, Corso Umbarto 1, 174, Rome; Fratelli Bocca, Rome; Ulrico Hoepli, Milan.
JAPAN.—Maruzen Co., Tokyo and Yokohama.
AFRICA.—Wm. Dawson and Sons, Limited, 7, Sea-street (Box 49), Capetown.
C. Juta and Co., Johannesburg, East London, and Grahamstown.
AUSTRALIA.—Gordon and Gotch, Limited, Melbourne, Sydney, Brisbane and Perth, &c.
Melville and Mullen, Melbourne.
Atkinson and Co., Gresham-street, Adelaide.
CANADA.—Dawson, Wm., and Sons, Limited, 87, Queen-street East, Toronto.
Gordon and Gotch, Limited, 132, Bay-street, Toronto.
Montreal News Co., 386–388, St. James-street, Montreal.
Toronto News Co., 42, Yonge-street, Toronto.
CEYLON.—Wijayartna and Co., Colombo.
JAMAICA.—Educational Supply Co., Kingston.
NEW ZEALAND.—Gordon and Gotch, Limited, Wellington and Christchurch; Upton and Co., Auckland; J. Wilson Craig and Co., Napier.
STRAITS SETTLEMENTS.—Kelly and Walsh, Limited, Singapore.
UNITED STATES OF AMERICA.—International News Co., 83 and 85, Duane-street, New York; Subscription News Co., Chicago.

## Agents Abroad for Advertisements.

UNITED STATES OF AMERICA.—British and Colonial Press, Inc., 161, East Erie-street, Chicago, Ill.
FRANCE.—Agence Vox, 7, Rue de Surène, Paris (VIIIe).
BELGIUM.—W. H. Smith and Son, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.

## SUBSCRIPTIONS.

The Engineer can be had, by order, from any newsagent in town or country, at the various railway stations; or it can, if preferred, be supplied direct from this office.

Half-yearly (including index number) .. £1 12s. 6d.
Yearly (including two index numbers) .. £3 5s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made.

**Foreign Subscriptions** will be received at the rates given below. Foreign subscribers paying in advance at these rates will receive The Engineer weekly and post free. Subscriptions sent by Post Office Order must be made payable to The Engineer and accompanied by letter of advice to the Publisher.

| Thin Paper Copies. | | Thick Paper Copies. | |
|---|---|---|---|
| Half-yearly.. .. | £1 11s. 6d. | Half-yearly.. .. | £1 13s. 9d. |
| Yearly.. .. .. | £3 3s. 0d. | Yearly.. .. .. | £3 7s. 6d. |

(The difference to cover extra postage.)

**Canadian Subscriptions—**
Thin paper edition .. .. £2 18s. 6d. per annum.
Thick paper edition .. .. £3 3s. 0d. „

*** Reading Cases, *to hold two copies of* The Engineer, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

## ADVERTISEMENTS.

*** The charge for Situations Open and Wanted Advertisements of four lines and under is four shillings, and one shilling per line for each additional line up to one inch. When an advertisement measures an inch or more the charge is twelve shillings per inch. The rates for all other classes of advertisements, other than those mentioned above, are included in "The Engineer Directory," which is sent post free on application. All single advertisements from the country must be accompanied by a remittance in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.

**Small Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication). ALTERATIONS to STANDING ADVERTISEMENTS must arrive not later than THURSDAY of the week preceding publication.**

*Letters relating to Advertisements and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters to be addressed to the Editor of* The Engineer.

## THE ENGINEER DIRECTORY.

This Directory, which is published annually in the interests of advertisers in The Engineer, may be obtained free of charge on application to the Publisher.

**Postal Address, 33, Norfolk-street, Strand, W.C. 2.**
**Teleg. Address, "Engineer Newspaper, Estrand, London."**
**Telephone Nos. 2256, 2257 Central.**

## PUBLISHER'S NOTICES.

*** *If any Subscriber abroad should receive* The Engineer *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

## TO CORRESPONDENTS.

*** *All letters intended for insertion in* The Engineer *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

*By arrangement with Reuter's Engineering Service,* **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*


## Contents.


| The Engineer, August 1st, 1924. | Page |
|---|---|
| A Seven-Day Journal | 121 |
| The British Empire Exhibition.—No. XV. (Illus.) | 122 |
| The Iron and Steel Industry in Canada | 125 |
| North-Eastern Railway—Dock Improvement Schemes | 129 |
| British Wire-Drawing and Wire-Working Machinery.—No. III. (Illus.) | 130 |
| Electricity Supply in South Africa | 131 |
| The Institute of Metals | 132 |
| Royal Aeronautical Society | 132 |
| Letters to the Editor— | |
| Train Performances on Midland Railway | 132 |
| World Power Conference | 132 |
| Railway Matters | 133 |
| Notes and Memoranda | 133 |
| Miscellanea | 133 |
| Leading Articles— | |
| The Naval Review | 135 |
| The Testing of Thin Sheet Metal | 136 |
| One Hundred Years of British Railways.—No. V. | 136 |
| Deepening Holyhead Inner Harbour | 137 |
| Books Received | 137 |
| Narrow-Gauge Mallet Locomotives for Burma. (Illus.) | 139 |
| The Weldex Air Heater. (Illus.) | 139 |
| The County Tyrone Colliery | 140 |
| Sixty Years Ago | 140 |
| Steam Turbines. (Illus.) | 140 |
| Educational Intelligence | 142 |
| Provincial Letters— | |
| The Midlands and Staffordshire | 143 |
| Lancashire | 143 |
| Sheffield | 144 |
| North of England | 144 |
| Scotland | 145 |
| Wales and Adjoining Counties | 145 |
| Launches and Trial Trips | 145 |
| Current Prices for Metals and Fuels | 146 |
| French Engineering Notes | 147 |
| British Patent Specifications. (Illus.) | 147 |
| Personal and Business Announcements | 148 |
| Contracts | 148 |
| Paragraphs— | |
| The House of Carmichael | 132 |
| Forthcoming Conference on Illumination | 142 |
| Harland and Wolff, Limited | 142 |
| The Institution of Electrical Engineers | 145 |
| A Century of Glass Making | 148 |


# THE ENGINEER.

*AUGUST* 1, 1924.

### The Naval Review.

The scene at Spithead on Saturday last, when the Royal yacht steamed down the long lines of men-of-war assembled there, was one of rare grandeur and majesty. Practically all the effective ships of the Navy now serving in home waters lay at anchor in this historic roadstead. Besides the fully commissioned Atlantic Fleet and its ancillary craft, part of the Reserve Fleet had been mobilised for the occasion, bringing the total of ships present up to 194. Many of these vessels, however, were not units of the fighting line. In contrast to the test mobilisation inspection of July, 1914, the armada which lay at Spithead included but a small proportion of capital ships. Of these there were only eleven all told. There were in addition nine light cruisers and two aircraft carriers, the remainder of the fleet consisting of destroyers, submarines, minesweepers, and depôt ships. How different the composition of the immense force which had filled the same anchorage ten years before! In the fleet which the King led to sea on July 20th, 1914, there were fifty-nine battleships, including twenty-four of the "Dreadnought" type, eighteen armoured cruisers, and thirty-one other cruisers. Of that matchless force scarcely anything now remains. At last week's review the Centurion was the only major ship present which had taken part in the pre-war assembly. A few other ships survive, it is true. The Iron Duke, the Marlborough, and four older battleships of the original fleet are still on the Navy List, but all the rest have vanished along with the cruisers, destroyers, and submarines of the same period. Losses in action, post-war economy, and the Washington Treaty have combined to play havoc with the naval material we possessed at the outbreak of war. This, no doubt, is common knowledge, but what seems to be less widely understood is the fact that a veritable fleet of ships built *after* the declaration of war has been sacrificed since the peace. The figures relating to British naval retrenchment are nothing less than astounding. Between the date of the Armistice and March, 1923, we had scrapped thirty-five battleships and battle-cruisers of 550,000 tons, eighty-two cruisers of 520,000 tons, 375 torpedo craft, 101 submarines, and 240 other naval vessels, making an aggregate of 1,600,000 tons. To this sum must be added 270,000 tons of ships scrapped before completion, and a very large number of miscellaneous vessels. In all, not less than 2,000,000 tons of combatant shipping have been abolished. Had subsequent events taken a normal turn some portion of the material thus discarded would have been replaced in course of time. But the urgent need for economy, coupled with the dictates of the Washington Treaty, has made it impossible, so far, to rebuild the Navy on up-to-date principles.

Thus the fleet we saw at Spithead on Saturday, despite the brave display it made, was not quite so formidable as many spectators doubtless assumed it to be. All the capital ships were of pre-war design; none of the cruisers was of modern, ocean-going type, and not all of the lighter craft could be depended on for efficient service in a new emergency. British naval strength has indeed suffered a marked decline since the peace. The German Navy, once so powerful and menacing, has been reduced to impotence, but against this must be set our voluntary renunciation of that pre-eminence afloat which had been ours for more than a century. In European waters we are as strong, relatively, as we were in 1914. But the Empire stretches beyond the confines of Europe, and elsewhere we have no margin of supremacy. That is a fact to which this fine array of ships at Spithead ought not to blind public opinion. Radical changes could be noted in the design of most of the ships present as compared with those inspected ten years earlier. In 1914 the newest battleships were the "Iron Dukes," of 25,000 tons, steaming at 21 knots, and armed with ten 13.5in. guns. Of battle-cruisers the latest representative was the Queen Mary, of 27,000 tons, capable of 28 knots, with a battery of eight 13.5in. guns. The Tiger, of rather more powerful design, had not then hoisted the pennant. To-day our finest battleships are the "Queen Elizabeths," displacing 27,500 tons. Four knots swifter than the Iron Duke, they mount the imposing armament of eight 15in. guns. Corresponding progress has been achieved in the less obvious though equally important feature of protection. Such of our ships as are equipped with bulges are better able than their predecessors to withstand torpedo attack. In the battle-cruiser class the Queen Mary has been eclipsed by the "Renowns," and to a far greater extent by the Hood, which is 14,000 tons heavier, at least 3 knots faster, and carries 15in. in place of 13.5in. guns. Nor have the lighter types lagged behind their big brethren in the swift march of progress. For cruisers a speed of at least 32 knots is now demanded. The destroyer has become a small cruiser in tonnage and armament, and the "E" submarines of 1914 have given place to under-water craft of dimensions that would have seemed fantastic ten years ago. Apart from its decline in numerical strength, we have no cause to be dissatisfied with the Navy of to-day. The quality of its material has improved. All save the oldest ships have oil-burning boilers and can maintain their legend speeds with ease. They can shoot further and hit harder than their forerunners, and at the same time are not so vulnerable to counter-attack above or below water. Technical equipment in all departments is more efficient and more dependable. If we have fewer heavy ships, we are better provided with the various auxiliary types, such as minesweepers, whose value in war is beyond calculation. Ten years since naval aviation was in a primitive stage of evolution. To-day we have a squadron of aircraft carriers, built and building, which no other navy can match. And, above all, our officers and bluejackets are second to none in training, experience, and devotion to duty. The Navy, to revive Lord Fisher's phrase, is "sound as a bell." It rests with Parliament and people to see to it that adequate provision is forthcoming for naval requirements in the years ahead. In this vital branch of national defence retrenchment has already gone beyond the limits of prudence.

Many of the capital ships in line at Spithead last week had played a doughty part at Jutland, that titanic combat of which the official narrative has just made a belated appearance. Years of pains-taking research went to the preparation of the volume. No less than 154 vessels were present under the British flag when the two rival fleets came into contact, for the first and last time, on May 31st; 1916. The action was fought at high speed almost from start to finish. Smoke from hundreds of funnels and guns aggravated the atmospheric gloom that prevailed for most of the time, whilst bursting shell and the huge splashes thrown up by projectiles striking the water decreased the poor "visibility." To many, as the authors of the narrative admit, the action must appear as "a grey mass of ships manœuvring in and out of the battle smoke, with no possibility of ascertaining their movements with clear and definite precision." This notwithstanding, patient study of track charts, navigational records, and the signals exchanged during the action have enabled Captain Harper and his colleagues to unravel the

tangle of movements made by our ships on that memorable day. Apart from its bearing on the professional controversy to which the Battle of Jutland has unfortunately given rise, the evidence of this book suggests a strong doubt as to whether the Grand Fleet, at the date of Jutland, had not become too unweildy for effectual control as a unit in action. It is clear at least that the means of inter-fleet communication then in vogue left much to be desired. Various signals of extreme importance were misread or not received at all. As a consequence, squadrons did not always support one another at critical moments, and misleading intelligence of enemy movements was not rectified in time. The stealthy withdrawal of the German Fleet after nightfall did not go unremarked, yet the news failed to reach the Commander-in-Chief until too late. For the Grand Fleet to develop its enormous powers of offence to the best advantage it was needful that close and continuous touch should be kept between all formations during action. That, however, was not done, perhaps because it was physically impossible. The actual time during which the battle fleet was directly engaged with the enemy was very brief. It was firing only for two periods of twenty and fifteen minutes respectively, and even then but a part of the German fleet was visible. Whether closer action might have been sought without taking undue risks is a question we do not propose to reopen. It should always be remembered, however, that the Grand Fleet, besides being the main defence of this country, was the factor that dominated the whole war. Had disaster befallen it, nothing could have saved the Allied cause from swift and overwhelming defeat. This thought, as we know, was ever present in Admiral Jellicoe's mind. If it led him to shun hazards which in his judgment were not essential to the furtherance of the broad purpose in view, we should surely hesitate to criticise his action on that account. Measured by its ultimate results, the battle was completely decisive. The true sequel to Jutland was witnessed, not when the High Sea Fleet limped into Wilhelmshaven the morning after, to be boastfully acclaimed as a conquering force, but when that same fleet was ignominiously shepherded into the Forth two and a-half years later, with every vestige of fight knocked out of it.

### The Testing of Thin Sheet Metal.

THIN sheet metal is not, as a rule, employed for purposes where any particular reliance is placed upon its strength, but if we take into account, not merely very thin material whose thickness is measured in gauge numbers, like 18 or 20, but include rather more substantial sections, the problem of satisfactory testing becomes of wider interest. Modern developments, particularly in aeronautical engineering, have, however, increased the importance of even very thin material, whether of steel or aluminium alloys. In the case of steel, particularly, the high density of the material demands, in the construction of aeroplane spars and airship frames, the use of very thin sheet or strip, and an adequate test of its quality is important. Naturally, the first tendency is to rely upon a tensile test, but its application to thin sheet metal is particularly difficult, for such metal shows a very great tendency to fail, not by normal tensile rupture, but by tearing. To avoid failure of this type, with its concomitant errors in regard to elastic limit, yield point or proof stress and ultimate strength, great care must be taken to ensure perfectly symmetrical gripping of the test piece and the avoidance of the smallest kind of irregularity in the test strip itself. Such delicacy of manipulation may perhaps be secured in a research laboratory, but in practice it becomes almost impossible.

If we must look upon tensile tests on thin sheet metal with doubt from the experimental point of view, the utility of the results in design is at least as great. In the very light type of structure for which this kind of material is employed, failure very rarely, if ever, occurs by tensile rupture, but rather by compressive buckling. The question arises whether tensile strength, either in terms of ultimate strength or of elastic limit, can serve as a guide to the crippling load of a part of such a structure. In such circumstances, it would seem that unless some novel form of simple test can be devised, the only rational course is to fall back upon a buckling test upon an actual strut made of the material in question. For this purpose, it would be necessary to press or form the strip into a standard shape, such as a tubular or channel section, and to test a standard length of such a section as a strut under compression. There are, however, difficulties about such a test. In the first place, the forming into standard section would require special appliances and considerable care and accuracy, while the test itself is of a special kind, in which great care is required in regard to the end conditions of the test piece. But there is a more serious difficulty in that the relative behaviour of two materials in a strut of given section and length might not always determine their relative value in struts of widely different design, where the modes of failure might differ in detail. In addition to this question of resistance to buckling when used as a strut, some importance also attaches to the ductility of thin strip material. It is usually required to undergo a good deal of cold work in the way of pressing or stamping, and comes into actual service after such treatment, which is sometimes of a severe kind. Where the material is thick enough to give a satisfactory tensile test, the elongation is an adequate guide to ductility; in very thin material, however, satisfactory results by this simple method are not easily obtained, as already remarked, and recourse is usually had to some form of bending or reverse bending test. More recently, various devices have been introduced by way of a cupping or punching test, in which the depth of cup which can be produced without cracking is regarded as the criterion of quality. This type of test seems to promise interesting data, but demands exhaustive study before it can be regarded as anything more than a rough empirical means of detecting seriously defective material. The reverse bending test, if properly carried out, is of a much more definite character, but if roughly done may be quite misleading. If a strip is bent in the ordinary way and then bent back again, the reverse bends do not as a rule take place at precisely the same spot—if the specimen is examined just before fracture, it will be found to have taken up an S shape, owing to the fact that the backwards and forwards bends occur at different places, and the behaviour of the specimen will depend upon exactly how far apart are the lines upon which these two bends take place. Bending machines are, however, available, which eliminate this defect, and bend tests made with them give consistent data in regard to the ductility of thin sheet metal. Another test is that known as the tear test—see THE ENGINEER, July 11th, 1924. In one form it consists in measuring the pull required to cause a "tongue" cut out from the edge of the sheet to tear, whilst in another more recent form the result of the test is gauged by the length of the triangular strip which is torn out from a sheet when such a tongue is pulled. In both cases the result appears to depend principally upon the ductility of the material and to give little insight into any other property.

It is clear from this brief survey that the whole question of the rational and satisfactory testing of thin sheet and strip requires much further investigation. In view of the increasing importance of very light structures, it is a subject demanding careful consideration at the hands, both of designers and those engaged in mechanical testing and its application to specialised materials.

## One Hundred Years of British Railways.

No. V.*

### PART I.—THE STOCKTON AND DARLINGTON RAILWAY AND ITS PREDECESSORS.

#### OTHER PRE-1821 RAILWAYS.

IT will come as a surprise to many to know that, in addition to the Surrey Iron Railway and the Croydon, Merstham and Godstone, and before the Stockton and Darlington was authorised in 1821 and independently of the eight railways sanctioned to be built by canal companies, twenty Railway Acts were passed. It is proposed to deal with them in the present article.

*Carmarthenshire.*—This was the second railway to be sanctioned. It was authorised on June 3rd, 1802, by 42 Geo. III., c. 80, to run from the river Bury in Llanelly to Castell-y-Garseg quarries in Llanfihangel-Aberbythych, in the Llandebie limestone district, 16 miles. Powers were also given to build a dock or basin on the river. The line was opened as far as Gorslas, 12 miles, in 1806, and one trip in each direction, by two horses, was made each day. The railway company went into liquidation in 1844; the dock was taken over by the Llanelly Harbour Commission, and in 1875 the Llanelly and Mynydd Mawr Railway Company was formed to convert the Carmarthenshire Railway from a tramroad into a railway.

*Sirhowy.*—Sanctioned June 26th, 1802, by 42 Geo. III., c. 115. This line was discussed in Article II. in relation to the Monmouthshire Canal.

*Oystermouth.*—By 44 Geo. III., c. 55, of June 29th, 1804, a railway or tramroad for the passage of wagons and other carriages from the Swansea Canal at Brewery Bank in Swansea to Castle Hill in Oystermouth, and a branch from the Mount in Swansea to Swansea Pier, and one from "a certain place near Black Pill to or nearly to a certain place called Ynys." It was opened in 1814.

A remarkable feature about this Act was that the "haling or drawing" of the wagons and other carriages was to be done with "men, horses or otherwise." There were, however, no powers to carry passengers. Despite this, the line was more used for passenger traffic than for goods. Passengers were conveyed in horse-drawn stage coaches, which certainly were running in 1816. Brewster's "Edinburgh Encyclopedia" (1824) said that "at Oystermouth a stage coach plies daily with passengers, which appears to be its chief trade."

The Oystermouth Company continued its existence until 1893, when a new company was formed. It was called the Swansea and Mumbles Railway Company, and, in 1899, it leased the property to the Swansea Improvements and Tramway Company, one of the concerns of the British Electric Traction Company.

*Kilmarnock and Troon.*—This was the first railway to be sanctioned in Scotland. It was authorised by 48 Geo. III., c. 46, of May 27th, 1808, to make a railway from Kilmarnock to Troon for the improvement of the Ayrshire estates of the Duke of Portland, who bore the cost of construction. The engineer was William Jessop. The length was 9 miles, and the gauge 4ft. Departing from the general practice on the wagon-ways in Scotland, plate rails were employed. This exception was explained by T. G. Cumming, in his "Illustrations of the Origin and Progress of Rail and Tram Roads" (1824), to be due to their "admitting waggons and carts of the ordinary construction which is particularly exemplified in the Troon rail-way, where, it appears, there are several kinds of waggons used but they are limited to certain restrictions, such as four-wheeled waggons with flat bottoms and low 'shelmets' for the purpose of carrying grain, limestone, timber, slates, &c., from the harbour (of Troon) to the mills at Kilmarnock. The carts commonly in use are allowed the benefit of the rail-way, provided the wheels are cylindrical and that no greater load shall be carried on each pair than 28 cwt. These carts are extensively used in the conveyance of timber, bark, &c., the same cart being made use of to carry these articles through the streets of the town, consequently a considerable saving of expense and trouble. . . ."

The line was worked by horses until the late 'forties. In 1817 Stephenson supplied the Duke of Portland with a locomotive, but it was found to be too heavy for the rails.

Like the Oystermouth Railway, there was a good amount of passenger traffic over the Kilmarnock and Troon Railway. The company had no powers to carry it, and the secretary told the 1839 Committee on Railways that a small tonnage was taken every time passengers were hauled, so many passengers being considered as equivalent to a ton.

By 9 & 10 Vic., c. 211, the Glasgow, Paisley, Kilmarnock and Ayr Railway Company—later the main constituent in the Glasgow and South-Western—acquired the Kilmarnock and Troon Railway. It was further authorised to convert it from a plate-way into an edge rail-way, to make it better adapted to the conveyance of passengers, to effect certain alterations and deviations, to adapt the line for locomotives, and to join it at both ends to the G.P.K. and A. Railway.

When the Glasgow, Paisley, Kilmarnock and Ayr Railway was opened from Irvine to Ayr in 1839, passengers from Kilmarnock by "the Duke of Portland's Railway" changed at Barassie.

*Gloucester and Cheltenham.*—Sanctioned April 28th, 1809, by 49 Geo. III., c. 23. It started at the basin of the Gloucester and Berkeley Canal, and ran by the side of the Gloucester and Cheltenham mail road to Knapp toll gate in Cheltenham, 9 miles. There was also a branch, 2¼ miles, to Leckhampton Hill, *i.e.*, to the quarries. William James, as related in Article III., was interested in the Leckhampton branch, and it is not without interest that at the present time there is being built a light railway to connect the quarries with the Great Western Railway at Charlton Kings.

The line between Gloucester and Cheltenham was subsequently jointly purchased by the Birmingham and Gloucester Railway—absorbed later by the Midland—and the Cheltenham and Great Western Union—afterwards part of the Great Western. A relic of the former days is to be found in the fact that one of the Midland signal-boxes at Gloucester is still known as "Tramway Junction."

*Bullo Pill or Forest of Dean.*—The Bullo Pill ran from the place of that name on the river Severn to Cinderford Bridge and was built without parliamentary sanction. The Forest of Dean Railway ran from Cinderford to a junction with the Severn and Wye, and the powers for its construction, given by 49 Geo. III., c. 158, of June 10th, 1809,

* No. IV. appeared July 25th, 1924.

covered the whole distance, 7¼ miles. By 7 Geo. IV., c. 47, of May 5th, 1826, the Forest of Dean Railway Company took over the Bullo Pill Railway. It subsequently was worked as part of the Severn and Wye Joint Railway, but retained its separate identity until absorbed by the Great Western Railway under the Railways Act, 1921.

*Severn and Wye Railway and Canal* was sanctioned by 49 Geo. III., c. 159, of June 10th, 1809, for a railway or tramway from the river Wye at Lydbrook to the river Severn at the Lower Forge or Cross Pill at Lydney. As there was not sufficient accommodation at the latter place for shipping coal, powers were given by 50 Geo. III., c. 215, in 1810, to make a canal, 1 mile in length, to Naas Point, and to build docks. The line was originally known as the Lydbrook and Lydney, but the name was altered by the just mentioned Act of 1822. This line was worked by horse power until 1865, and in 1870 powers were obtained to convert it to a passenger-carrying line, and to join it to the Great Western system.

*Monmouth.*—By 50 Geo. III., c. 123, of May 14th, 1810, a line was sanctioned from Howler Slade in the Forest of Dean, by Coleford, Newland and Redbrook, to Monmouth. It is now part of the Great Western system.

*Penclawdd Canal.*—This line, and railways or tramroads connected therewith, ran from the river Bury at Penclawdd to Loughor, and all were sanctioned by 51 Geo. III., c. 106, of May 21st, 1811. The writer can find no trace of their being built.

*Hay.*—This railway ran from the Brecknock and Abergavenny Canal at Brecon to Eardisley. It was sanctioned by 51 Geo. III., c. 122, of May 25th, 1811, but its route was altered the following year by 52 Geo. III., c. 106. Part of this line was used in the construction of the Brecon and Merthyr Railway and part for the Hereford, Hay and Brecon.

*Llanvihangel.*—This line was sanctioned May 25th, 1811, by 51 Geo. III., c. 113. It extended from the Brecknock and Abergavenny Canal at another point and ran from Llanwenarth in a north-easterly direction to Llanvihangel, 7 miles distant, where it joined the Grosmont Railway.

*Berwick and Kelso.*—By 51 Geo. III., c. 133, of May 31st, 1811, a railway on the Anglo-Scottish border, running from Spittal, *vid* Coldstream to Kelso, was sanctioned. It was, however, never built. The Act for its construction was noteworthy in that, for the first time, a charge for passengers was authorised. This was done by Sec. 55, which recited that for every carriage conveying passengers or light goods or parcels not exceeding 5 cwt., such sums could be charged as the company should appoint, but not exceeding 2d. per mile. A bridge was to be erected over the Tweed at Coldstream, which was to be available for vehicular and foot traffic. Sec. 56 authorised tolls for such use.

*Grosmont.*—This was a continuation of the Llanvihangel Railway in the Hereford direction as far as the 12th milestone from that city. It was sanctioned on May 20th, 1812, by 52 Geo. III., c. 107.

*Penrhynmawr.*—This was a railway, 7 miles in length, situated in the Isle of Anglesey. It ran from the quarries at Penrhynmawr to Red Wharf Bay, where a dock was sanctioned. Brewster's "Edinburgh Encyclopedia" (1824) spoke of it as "a pretty old establishment and its good condition affords an example of the stability of the edge-railway."

*Kidwelly Canal.*—Under Geo. III., c. 173, of June 20th, 1812, powers were given to improve the harbour of Kidwelly and to make a canal and a railway or tramroad from a canal, already made, in the parish of Kidwelly, called "Kymer's Canal," to the Old Castle House in Llanelly, and for one from the east or upper end of Kymer's Canal to Pwll-Llygod in Penbrey, together with branches. It subsequently became part of the Burry Port and Gwendraeth Valley Railway.

*Mamhilad.*—This was another railway connected with the Brecknock and Abergavenny Canal. It ran from Mamhilad to the bridge over the river Usk at Usk, and was 5 miles in length. It was sanctioned by 54 Geo. III., c. 101, of June 17th, 1814. It is sometimes called the Usk Tramroad.

*Peak Forest, Beard and Woodlands.*—Sanctioned by 56 Geo. III., c. 29, of June 21st, 1816, but construction was never begun.

*Mansfield and Pinxton.*—By 57 Geo. III., c. 37, of June 16th, 1817, a line was sanctioned from the Pinxton Wharf of the Cromford Canal, 5 miles north of Eastwood, through Kirkby-in-Ashfield and Sutton-in-Ashfield, to the Portland Wharf in Mansfield, 7¾ miles in length. It was completed in 1819, and the construction included a bridge of five arches, about 1 mile from Mansfield. There was a branch to the Codnor Park Works of the Butterley Company. William Jessop's brother, Josias, was the engineer. It was absorbed by the Midland Railway under 10 and 11 Vic., c. 191.

*Kington.*—Authorised by 58 Geo. III., c. 63, of May 23rd, 1818, for a line from the Hay Railway at Eardisley to Kington in Radnorshire and to the lime works at Burlinjob, a distance of 14 miles. At Kington the line passed by the end of the Leominster Canal. Later, it became the main part of the Eardisley–Kington–New Radnor branch of the Great Western.

*Plymouth and Dartmoor.*—Authorised by 59 Geo. III., c. 115, of July 2nd, 1819. The railway ran from Bachelor's Hall, west of Princetown and "at no great distance from the prison erected for the reception of prisoners of war on Dartmoor," to Crabtree in the parish of Egg Buckland, *i.e.*, to Laira. By 1 Geo. IV., c. 54, of July 8th, 1820, an extension to Sutton Pool was sanctioned. Incidentally, this addition carried the line to the south of the path later taken by the South Devon Railway, and the latter crossed the Dartmoor line on the level.

The line is now out of use, but, compared with other old railways, is hardly derelict. One very short length—about half a mile—remains in actual use, but modernised. It forms a connection between the Great Western Railway and the Lee Moor China Clay Tramway, 6 miles long, which branch is crossed on the level by the Launceston branch of the Great Western Railway. That part of the extension south of the South Devon Railway is now absorbed in the sidings at Laira. Some part of the northern end of the Dartmoor Railway was used in the construction of the Princetown branch of the Great Western.

*Hereford.*—This railway was not sanctioned until May 26th, 1826—7 Geo. IV., c. 100—but it is advisable to mention it here as it filled the 14 mile gap between the Grosmont Railway at Monmouth Cap and the city of Hereford.

Under an Act passed in 1845 the Monmouth and Hereford Railway Company obtained powers to make use of the Llanvihangel, Grosmont and Hereford tramways, but as they were not exercised the lines passed to the Newport, Abergavenny and Hereford.

George Overton, whose name frequently occurs in the history of the evolution of the Stockton and Darlington, writing in "A Description of the Faults or Dykes of the Mineral Basin of South Wales" (1825), said, in reference to these railways in South Wales and the counties of Monmouth and Hereford: "The lime-works (at Old Radnor) although a distance of 55 miles are principally supplied (with Welsh coal) from a colliery belonging to my partner and myself; the coal passing from Monmouthshire through part of Brecon and Hereford into Radnorshire, over a tramroad 55 miles in length, if we except the intervention of 7 miles of canal." Overton added that, were 4 miles of new tramroad laid and a bridge built over the river Usk, the 7 miles of canal and 4 miles of the then tramway could be dispensed with.

## Deepening Holyhead Inner Harbour.

ON November 4th, 1920, the London and North-Western Railway Company succeeded in securing from the Government the contract for the conveyance of the mails between Holyhead and Kingstown, a duty which for several years had been performed by the City of Dublin Steam Packet Company. The contract was for a period of twenty years from November 28th, 1920, and a clause called for the journey to be made in 2¾ hours.

It is, of course, generally known that the mail boats arrive at and depart from the Admiralty Pier, which is situate in the outer harbour. The North Wall and Greenore boats use the inner harbour, as did the Kingstown afternoon service when it was running. The railway station and hotel are at the inner end of the latter harbour. The hotel is seen in the background on the right in Fig. 3, page 134, and on its left may be observed the roof over part of the station. The hotel is seen also on the left in Fig. 4, and to its right is the roof over another part of the station. The steamer on the left in Figs. 1 and 2 is lying at the Admiralty Pier.

From the description we have just given it will be appreciated that there is some distance from the Admiralty Pier to the berths in the inner harbour. If, then, the use of the latter, despite the further steaming necessary, would allow for an ultimate reduction in the combined rail and steam journey time it is obvious that the approach to the berthing station in the inner harbour would be much better than that to the Admiralty Pier. But there were other reasons to justify the undertaking of the work of deepening the inner harbour. There would then be no need for loaded trains to proceed to the Admiralty Pier and for them to return empty, nor for empty trains to go to meet incoming mail steamers. Loaded and empty mileage would thus be saved, and there would be no necessity for the small locomotives that, owing to the sharp curves, necessarily have to be employed between the station and the pier. Then, the boats would be near to the company's hotel for arriving passengers and for those staying in the hotel to join the boat or the mail trains.

Having decided to deepen the harbour one of the first actions of the railway company was to get a special late Act in the Session of 1921 to extend, for a further period of ninety-nine years, the lease under the Government of certain property. The next was to obtain tenders for the deepening, and the result of this latter was the placing of the contract with the Tilbury Contracting and Dredging Company, Limited, of Queen Anne's Chambers, Westminster. With the completion of the work we are now able, by the courtesy of Mr. E. C. Trench, engineer-in-chief to the London, Midland and Scottish Railway Company, and with the co-operation of the firm just named, to give a few particulars of what has been done.

In the foreground in Fig. 3 will be seen the Lobnitz rock breaker employed on the work, wherewith the breaking of the rock was done by a heavy pointed steel ram. There were about 160,000 tons of rock to be broken up and then lifted by the two bucket dredgers—seen also in Fig. 3—and deposited into steam hoppers—Fig. 4—to be taken out to sea.

The dredgers first cleared all the overlying silt and the rockbreaker followed. The latter was moored very tightly and manœuvred by means of six winches. The rock, as a rule, was pierced to a depth of 3ft. by the ram, and the movement forward for each hole was just sufficient for the newly broken rock to fall into the hole just made behind it. After a certain distance had been covered the breaker would return and follow a parallel line adjoining the length of holes it had just made. The dredger would follow and pick up the broken rock, of which examples are seen in Fig. 1. This done the rockbreaker again would go over the ground until the requisite depth had been obtained. Fig. 2 shows the channel after the work had been completed. Very fine and frequent plotting and sighting were necessary for the rockbreaker's work, but they were so well done that the vessel could always again accurately take up any desired position.

An interesting and exceedingly useful feature of the equipment used was a sleeve guide for the ram. Instead of having a guide fixed to the vessel—which meant that its effective working length was limited—the guide was fixed in a sleeve suspended from the sheerlegs fixed on the bow of the vessel. The sleeve could be adjusted in height to suit the depth of water above the rock, and the ram need not be above 2ft. from the face of the rock. A perpendicular blow was thus ensured, and this was particularly useful when working on a slope.

A good amount of rock was raised by one of the two dredgers without the intervention of the rockbreaker, which had a new and interesting feature in the shape of a slipping friction clutch. This came into play when an excessive load was met with, and disengaged the main driving gear so that it could not be damaged. The contractors say that this clutch was one of the prominent contributory causes towards the useful work done by the dredger in removing both broken and unbroken rock.

## BOOKS RECEIVED.

*Elasticity and Strength.* Volume IV. C. A. P. Turner, Consulting Engineer, U.S.A. Price 5.00 dollars.

*Der Uebersee-Maschinenhandel.* Wilhelm Thiemann. Berlin: Julius Springer, Linkstr 23-24. 2.65 gebunden dollar.

*The Journal of the Institute of Metals.* Edited by G. Shaw Scott, M.Sc. London: 36, Victoria-street, S.W. 1. Price 31s. 6d. net.

*Ministry of Public Works, Egypt: Some Experiments on the Rating of Current Meters.* By P. Phillips. Cairo: Government Press.

*The Design and Working of Ammonia Stills.* By P. Parrish. London: Ernest Benn, Limited, 8, Bouverie-street, E.C. 4. Price 40s. net.

*Business First Principles.* By A. F. Shepherd. London: Business Builders, Limited, Crew House, Great Ormond-street, W.C. 1. Price 1s. net.

*Vibration in Engineering.* By Julius Frith and F. Buckingham. London: Macdonald and Evens, 8, John-street, Bedford-row, W.C. 1. Price 7s. 6d. net.

*The Kinetic Theory of Gases.* By Eugene Bloch. Translated by Philip A. Smith. London: Methuen and Co., 36, Essex-street, Strand, W.C. 2. Price 7s. net.

*Thermionic Tubes in Radio Telegraphy and Telephony.* By John Scott-Taggart. London: The Wireless Press, Limited, 12 and 13, Henrietta-street, W.C. 2. Price 15s. net.

*The Calculation and Measurement of Inductance and Capacity.* By W. H. Nottage. London: The Wireless Press, Limited, 12 and 13, Henrietta-street, W.C. 2. Price 7s. 6d. net.

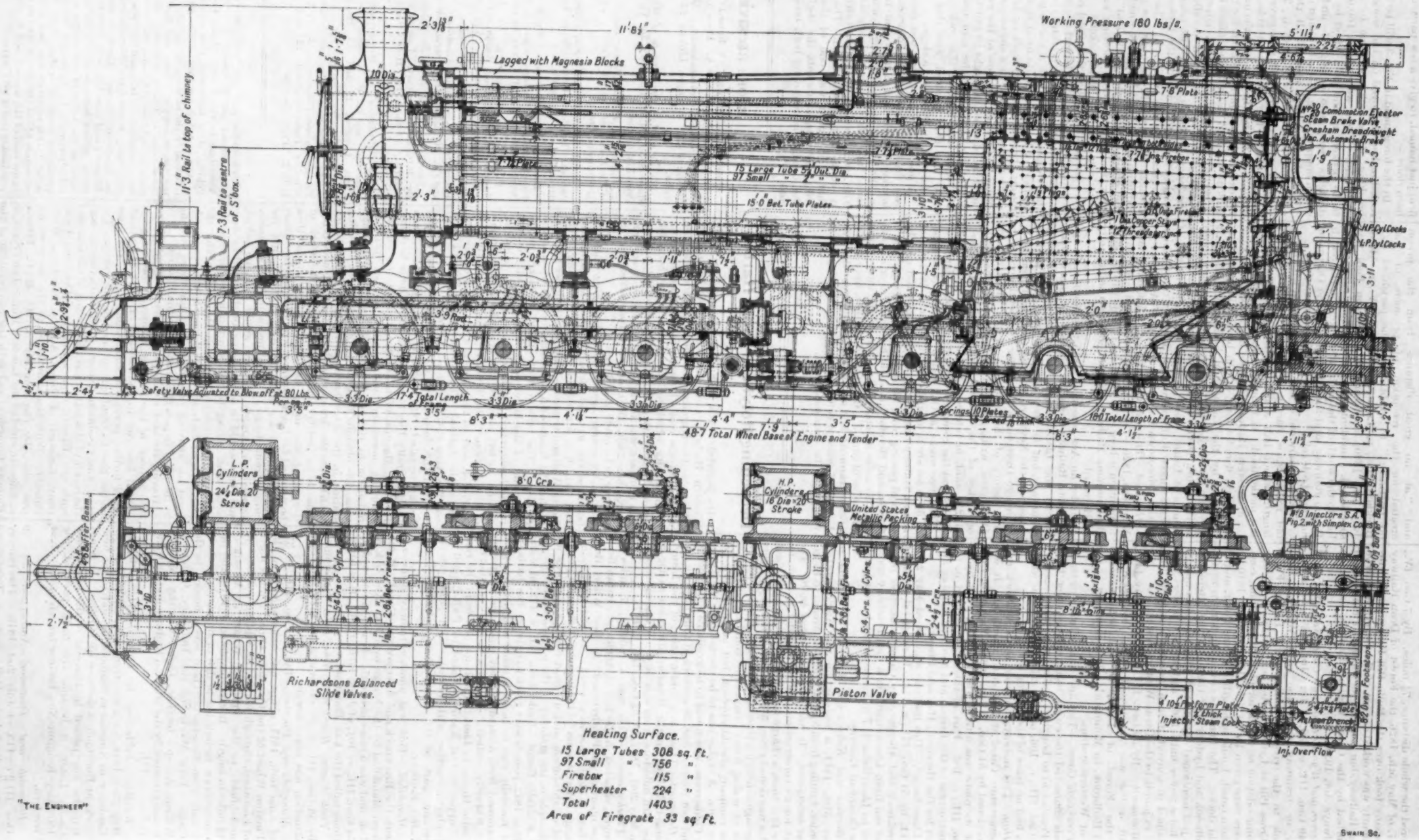
*The Thermionic Valve and its Developments in Radio-Telegraphy and Telephony.* By J. A. Fleming. London: Wireless Press, Limited, 12 and 13, Henrietta-street, W.C. 2. Price 15s. net.

DURING the past few years the various mints in China have turned out enormous quantities of copper coins. According to the United States Commercial Attaché at Peking, it is estimated that those now in circulation in the country number about 40,000,000,000. Copper is in reality the medium of exchange of the masses. With the fall in copper prices, and the wholesale minting of these coins in China, including the production in some cases of light-weight coins, the value of the copper cent has continued to fall, and has reached such a low level that many mints have discontinued its coinage as being no longer profitable. There is still, however, one other difficulty and that has to do with the issue of copper cent notes, which have been circulated on about the same basis as the value of the copper coins, and have shown little tendency to depreciate, except in cases of certain provincial issues other than those of the central Government. This situation has had a serious effect upon the economic life of the people for the reason that the copper is the coin of the masses, and its depreciation affects their purchasing power very seriously.

# METRE-GAUGE MALLET LOCOMOTIVE FOR BURMA

WILLIAM BEARDMORE AND CO., LIMITED, DALMUIR, ENGINEERS

(For description see opposite page)


Working Pressure 160 lbs/s.
Lagged with Magnesia Blocks
11'3" Rail to top of chimney
7'3 Rail to centre of S' box.
15 Large Tube 5¼" Out. Dia.
97 Small " 2" "
15'0 Set. Tube Plates
7/8 Plate
No 30 Combination Ejector Steam Brake Valve Graham Dreadnought Vac. Automatic Brake
L.P. Cyl Cocks
L.P. Cyl Cocks
Safety Valve Actuated to Blow off at 180 Lbs Per sq. in.
Total Length of Frame
48'7 Total Wheel Base of Engine and Tender
Springs 10 Plates 3" Broad ⅞ Thick
160 Total Length of Frame
L.P. Cylinders 24½ Dia. 26 Stroke
8'0 Crs.
Richardsons Balanced Slide Valves.
H.P. Cylinders 16 Dia. 26 Stroke
United States Metallic Packing
Piston Valve
No 8 Injectors S.A. Fig. 2 with Simplex Cone
Platform Plate ½ Thick
Injector Steam Cock
Graham Dreadnought
Inj. Overflow

Heating Surface.

| | | |
|---|---|---|
| 15 Large Tubes | 308 | sq. Ft. |
| 97 Small " | 756 | " |
| Firebox | 115 | " |
| Superheater | 224 | " |
| Total | 1403 | |

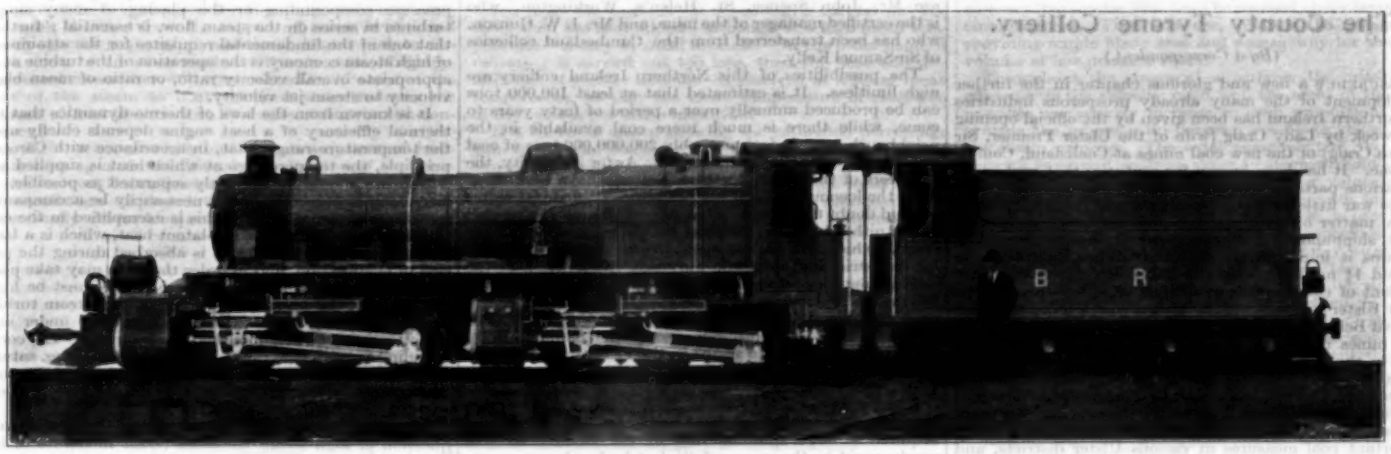
Area of Firegrate 33 sq. Ft.

"THE ENGINEER"

SWAIN Sc.

# METRE-GAUGE MALLET LOCOMOTIVE FOR BURMA

WILLIAM BEARDMORE AND CO., LIMITED, DALMUIR, ENGINEERS



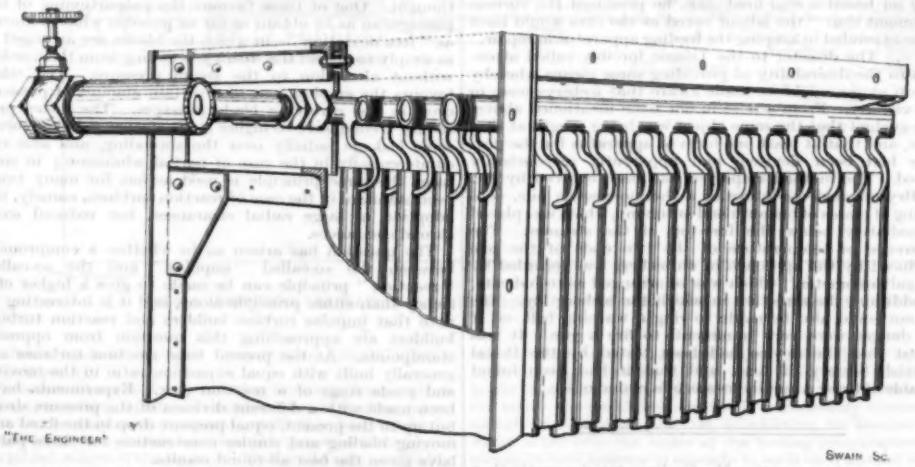
## Narrow-gauge Mallet Locomotives for Burma.

FIVE metre-gauge locomotives have been recently completed by William Beardmore and Co., Limited, at their Dalmuir Works, and sent to Burma. They are of the compound articulated type, and are illustrated above and by the general arrangement drawing given on page 138. The service on which they will be engaged is an extremely severe one, both as regards gradients and curves. At Loybyin, for example, the line zigzags up a hillside with a steady gradient for 17 miles of 1 in 25 and curves of 337ft. radius. At four places the train has to change direction, and the engine alternately pushes and pulls it up the hill. At Sedaw on the Northern Shan branch, a similar climb, 11 miles in length, has to be faced. These are possibly the worst parts of the many branches of the Burma Railways, but gradients of 1 in 40 are quite common and the whole line is as difficult as it is picturesque.

The nature of the service explains the design of the engine. The driving wheels are 39in. in diameter, while the high-pressure cylinders on the rear engine are 16in. by 20in., and the low-pressure cylinders on the leading engine are 24½in. by 26in. With a working pressure of 180 lb., the starting tractive effort is 30,000 lb. It will haul a train of 140 tons behind the tender up gradients of 1 in 25 at 10 miles an hour and trains of 220 tons up 1 in 40 at higher speeds. The boiler is of large capacity, having in all 1180 square feet of evaporating surface and 224 square feet of superheater area. The grate has an area of 33 square feet. The steam distribution valves are of the piston type in the high-pressure and of the balanced slide type in the low-pressure cylinders. For the rest, the illustration gives all essential particulars. The lifting shackle fixed permanently to the first course of the boiler barrel is an interesting detail.

## The Weldex Air Heater.

THE apparatus illustrated in the accompanying engravings is called by its maker—the Victoria Tube Company, Limited, of Great Bridge, Staffordshire—the Weldex air heater. This apparatus, which is patented, and which is claimed to be particularly suited for use in factories,



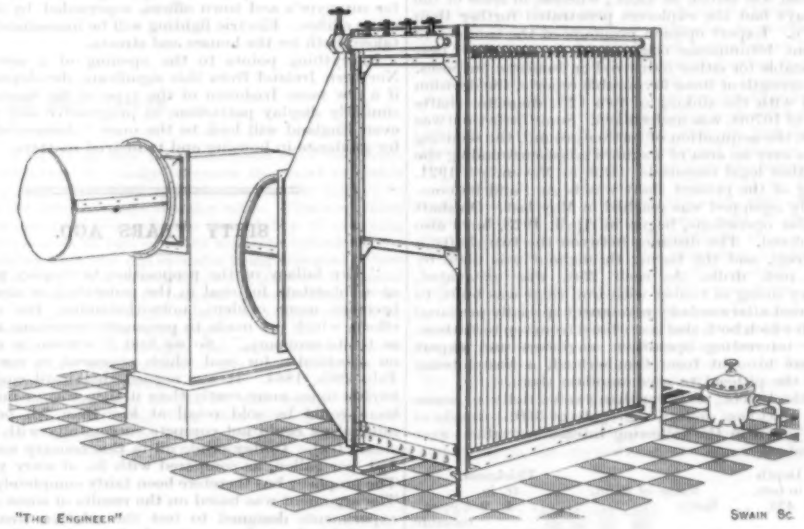
"THE ENGINEER" SWAIN Sc.

FIG. 1—ARRANGEMENT OF WELDEX AIR HEATER

workshops, paper mills, dye-houses, all descriptions of drying operations, air washing for theatres, &c., and for certain process work, possesses several attributes which differentiate it from other types of heaters. It consists, as will be observed, in a number of sets of vertical heating tubes arranged between a pair of top and bottom tubes to form a grid or section. The heating tubes are connected to the lower header tubes by means of stamped spigoted caps, the spigot being welded to the header and the cap to the heating tube. These caps are drilled through, and the hole thus formed is lined with a non-corrosive metal sleeve with the purpose of preventing any possibility of obstruction by rust to the proper drainage of the tube. Similar caps are employed for the upper ends of the heating tubes, when the apparatus is to work with hot water or low-pressure steam. When, however, the heating medium is high-pressure steam, the end of the header tube is welded up, and expansion bends of small-diameter weldless tubes form the connections between the header tubes and the heating tubes, the junctions in all cases being welded. This construction, the makers assert, entirely does away with troubles due to expansion and contraction. It will be readily understood that the construction is very different from that usually employed in which the heating tubes are screwed or expanded into a cast iron base.

The header tubes are correctly proportioned to feed the heating tubes. One end is welded up, as already explained, while the other is screwed to suit a special form of joint which makes connection with a manifold branch pipe that couples up the various sections of heater tubes forming the complete battery. The manifold pipes are constructed of wrought iron tube with the branches welded on, and separate valves are employed so that each or all the rows of heater tubes can be used at will. Hence temperature regulation within wide limits, as well as very fine temperature graduation, can be effected. Arrangements can also be made whereby the battery of tubes can be divided up into one or more groups of sections, so as to allow of both exhaust and live steam to be employed at the same time.

The whole nest of tubes is enclosed in a casing, as may be seen in Fig. 2, which shows a complete heater coupled



"THE ENGINEER" SWAIN Sc.

FIG. 2—AIR HEATER UNIT AND FAN

to a fan. The ends of the header tubes project through the sides of the casing, so that the joints on the branches—the only joints in the battery which are not welded—are readily accessible. The welded joints, it may be explained, are subjected to rigorous pressure and hammering tests, with the object of discovering possible flaws. The firm's standard casing is built up of heavy gauge galvanised sheet steel panels for the top and sides, with angle bracings and flanges drilled to connect to the inlet and outlet trunks. The side panels are connected to a channel-framed base, which is furnished with angle bearers to carry the bottom headers of the sections of heater pipes. The top headers are carried by drilled plates attached to the side panels in such a way that they are free to rise and fall, and no stresses due to expansion or contraction are imposed upon the sections. In some cases thermostatic valves, arranged to operate one after the other, are fitted to several sections in a battery. The makers point out that this provision ensures a much more positive and rapid result than can be brought about by throttling the steam supply to large sections containing a number of rows of tubes.

The makers claim that the following special advantages are possessed by their type of air heater:—

(1) The positive and calibrated supply of steam to the top of each heating tube eliminates air pockets and ensures a continuous high efficiency of the heating surface, as there is no conflict in the direction of flow of the steam and condensate;

(2) The welding-up of each section into a homogeneous unit, and the provision for unequal expansion, reduces to a minimum the possibility of leakage in use;

(3) The whole of the heating unit is made of wrought iron or steel, and is circular in section, so that high steam pressures may be employed if desired;

(4) Duty for duty, the "Weldex" battery is lighter than any other type, and occupies less floor space;

(5) The sections, since they each contain only one row of tubes, are readily formed into a battery, and the absence of any fitting work beyond making the special joint between the manifold pipes and the headers saves considerable time, and reduces the risk of leakage to a minimum. It is explained that jigs are employed throughout the processes of manufacture to secure the correct assembly of the various components.

The makers further state that in exhaustive tests carried out with their heaters during the last few years, very high efficiencies, which they attribute to the positive steam distribution and to freedom from short circuiting, have been

obtained. We may add that the Victoria Tube Company, which is primarily a maker of tubes, manufactures these heaters, but does not undertake any installation work.

## The County Tyrone Colliery.

(*By a Correspondent.*)

Assuredly a new and glorious chapter in the further development of the many already prosperous industries in Northern Ireland has been given by the official opening last week by Lady Craig (wife of the Ulster Premier, Sir James Craig) of the new coal mines at Coalisland, County Tyrone. It has been known for centuries that coal exists in various parts of Northern Ireland, but until the years of the war little enterprise was shown in its development. As a matter of fact, all the coal required by Belfast's great shipbuilding, linen, engineering and other manufactures is imported across the Irish Sea, and averages around 1¼ million tons, valued at over £2,000,000, independent of considerable quantities imported through the other Ulster seaports. Much of this coal is imported by a shrewd Belfastman, Sir Samuel Kelly, who, besides owning coal mines in Cumberland, controls the largest coasting fleet in the British Isles—almost three dozen well-found steamers.

Recently, the Commission on the Natural and Industrial Resources of Northern Ireland reported to the Northern Ireland Government that there were undoubtedly very important coal measures in various Ulster districts, and recommended that the Government should financially aid their working in every manner possible. However, Sir Samuel Kelly, with the characteristic courage of the Belfast business man, determined to undertake the enterprise "off his own bat." Selecting the district at Coalisland, County Tyrone, right in the heart of Ulster and 44 miles from Belfast, with which it is connected by direct rail and canal, as the most hopeful area, he began extensive experimental boring. Its success almost immediately impelled him to take up the project as a commercial undertaking. Coal was struck at 433ft., whereas in none of the earlier essays had the explorers penetrated further than 300ft. down. Expert opinion pronounced the samples to be excellent bituminous coal, equal to the very best Scotch, suitable for either industrial or domestic purposes.

On the strength of these favourable reports, the decision to proceed with the sinking of two 12ft. diameter shafts to a depth of 1070ft. was undertaken. Some little time was occupied in the acquisition of further ground, the securing of royalties over an area of 4 square miles surrounding the pit, and other legal essentials. But in November, 1921, the sinking of the present shaft was begun, and its completion fully equipped was reached in May last. On shaft No. 2 similar operations, begun in April, 1923, have also been completed. The distance between the two shafts is 62ft. (centres), and the boring throughout was done by air-driven rock drills. As each 25ft. was excavated, a temporary lining of timber with iron rings was built, to be substituted afterwards by permanent specially prepared blocks with which both shafts are lined from top to bottom. For these interesting operations engineers and expert sinkers were brought from Cumberland, a hostel being erected at the pithead to accommodate them.

Within the 1070ft., no fewer than twelve rich coal seams of varying thickness and an aggregate of 36ft.—details of which are given in the following interesting table—were encountered :—

| No. | Depth in feet. | Name of seam. | Thickness. ft. | in. | |
|---|---|---|---|---|---|
| 1 | 433 | Kelly | 4 | 9 | Upper measure |
| 2 | 476 | Crow | 0 | 6 | |
| 3 | 542 | Annagher | 9 | 6 | |
| 4 | 570 | Bone | 6 | 3 | |
| 5 | 625 | Shining | 2 | 6 | |
| 6 | 691 | Brackaville | 4 | 6 | |
| 7 | 761 | Beltiboy | 2 | 0 | Middle measure |
| 8 | 775 | Monkey | 0 | 9 | |
| 9 | 806 | Two Foot | 2 | 6 | |
| 10 | 898 | Rock Coal | 0 | 9 | |
| 11 | 950 | Ten Inch | 1 | 0 | |
| 12 | 986 | Derry Five Foot | 2 | 3 | |

All the junctions are secured with brickside walls and heavy steel girders, and the roadways with circular steel girders and reinforced concrete. The water difficulty was never by any means formidable during the operations; but at No. 3 level a triple ram pump forces the entire water to the surface, and, indeed, is capable of dealing with four times the volume encountered.

Simultaneously with shaft sinking, the erection and equipment of the necessary pithead structures was proceeded with, and in due course appeared the two engine-houses and the power station—which they sandwich—the screening and washing plant, the overhead equipment and the series of mechanics', smiths', joiners' and other shops and stores, lamp room, &c. Simultaneously also another extensive transformation was going on in the cutting and laying of 5000ft. of sidings from the adjacent Great Northern Railway line into the colliery premises, where trucks are loaded direct from the screens and washery. There are eight sidings in all, four under the screening plant, one for loaded wagons, and three for empties.

Each of the shafts is fitted with two double-decked cages, each holding twin tubs, capable of carrying 10½ cwt. of coal apiece. These cages are controlled by a pair of horizontal 250 horse-power engines in each engine-house, with 12ft. diameter drums, on each of which a double set of reverse winding cables simultaneously lift and lower the cages. The winding cables were tested to 50 tons, a very liberal margin, when the total weight they take in actual working is 5 tons. The cages are kept in a vertical plane by six steel wire guide ropes suspended from the headgear and weighted at the bottom by 4½ tons cast iron "cheeses."

The very extensive and modern screening plant is driven by a 50 horse-power three-phase motor, housed in a fire-proof apartment, with fool-proof fuse boxes and controller. All the steel work of the headgear, gantry screens, picking table and washery was constructed by the Blantyre Engineering Company, Limited, Glasgow.

Every precaution has been taken to see that all the stipulations of the Coal Mines Regulations Act are scrupulously observed, and one cannot fail to be struck by the frequent and conspicuous notices throughout the colliery. Sir Samuel Kelly has had the skilled assistance of Mr. Thomas S. Durham (Whitehaven), an expert in opening up new mines, as consulting engineer. Others on the staff are Mr. John Spence, St. Helen's, Workington, who is the certified manager of the mine, and Mr. J. W. Gunson, who has been transferred from the Cumberland collieries of Sir Samuel Kelly.

The possibilities of this Northern Ireland colliery are nigh limitless. It is estimated that at least 100,000 tons can be produced annually over a period of forty years to come, while there is much more coal available in the neighbourhood. In fact, probably 200,000,000 tons of coal are located in the contiguous basin. As for its quality, the engineers of the Great Northern Railway have been using it for the locomotives and are perfectly satisfied. It seems beyond doubt that within a few years there may be erected at the pithead a powerful plant for the production of electricity, which will be supplied all over Northern Ireland for industrial and domestic purposes, the position of the mines being very central for this purpose. At present, over 200 miners from Scotland are at work, but this number will grow into over 1000 during the next few months. In fact, it is also in the programme of Sir Samuel Kelly to open up the iron ore seams in the vicinity, so that this development means more than appears on the surface to Ulster's progress.

Even at present, Sir Samuel Kelly's enterprise has not been confined to the coal mine alone, for not only has he acquired a large spinning mill in the vicinity to give employment to the women folk, but he has begun a new Irish town, already known as Newtownkelly. A large area on an upland site has been laid out in broad parallel streets, well drained and with good garden areas at the rear of every house. Already over 100 of these houses—model dwellings for miners, each with its parlour, kitchenette, scullery, three bedrooms, bath, wash boiler, &c., let at only 7s. 6d. weekly—have been built and provision has been made for 300 more. A church is already open and a cinema is in course of erection, and it may be that a decade hence will see the present temporary caravan, doing duty for surveyor's and town offices, superseded by an ornate stone edifice. Electric lighting will be immediately undertaken, both for the houses and streets.

Everything points to the opening of a new era for Northern Ireland from this significant development, and if a few more Irishmen of the type of Sir Samuel Kelly, similarly display patriotism so progressive and practical, even England will look to the once "distressful island" for guidance in housing and industrial matters.

### SIXTY YEARS AGO.

"The fallacy of the proposition to employ petroleum as a substitute for coal in the generating of steam daily becomes more evident, notwithstanding the continued efforts which are made to propagate erroneous assertions as to its economy." So we find it written in an article on substitutes for coal which appeared in our issue of July 29th, 1864. It was argued that until coal became twelve times more costly than it then was or until petroleum could be sold retail at less than 3d. per gallon, mineral oil could not compete successfully with coal as a steam fuel. To-day crude oil in this country costs about 3½d. per gallon, as compared with 2s. of sixty years ago. The prophecy has therefore been fairly completely fulfilled. The argument was based on the results of some American experiments designed to test the relative steam-raising capacities of petroleum and coal. It was found that 2000 lb. of anthracite, at £2 5s. per ton, had the same steam-raising value as 1252 lb. of petroleum. Discussing the advantages alleged in favour of petroleum, other than its heating value, the writer of the article—it was reprinted from the *Mining Journal*—mentioned the claim made that the use of petroleum on board ship would reduce fuelling times by 90 per cent. He held, however, that this advantage was "more imaginary than real," but did not explain what reasons he had for coming to that conclusion. Against the claim that the employment of petroleum would reduce the number of stokers required to one-fifth of those necessary on board a coal-fired ship, he produced the curious argument that "the labour saved at the fires would have to be expended in keeping the feeding apparatus in repair." . . . The disaster to the Titanic forcibly called attention to the desirability of providing some means whereby a ship at sea might be made aware that icebergs were in her vicinity. From a note in our issue mentioned above, it is evident that the same object was being sought at that time, and that at least one form of apparatus for the purpose had been devised, and apparently satisfactorily tested. The method employed had been evolved by Mr. A. Bryson, and made use of a thermo-electric pile, consisting of plates of bismuth and antimony, which was placed immediately below the fore-top of the steamer. The difference of temperature of the two ends of the pile produced by the approach of an iceberg was recorded by a "galvamometer," which was so arranged as to indicate, in addition, the direction in which the iceberg lay. The system could also be made to ring a warning bell, or, if the danger were very imminent, to fire a gun. It was stated that the device had been tested by the Royal Scottish Society of Arts, and that it had been found capable of firing a gun by means of a pound of ice.

In answer to a question Mr. Gosling stated recently that he had brought the question of converting the underground lines in Glasgow to electrical operation to the notice of the railway companies concerned, and was informed by the London, Midland and Scottish Railway Company that the question of the electrification of the Glasgow Underground Railway systems had received consideration, but that there was no prospect of securing such additional traffic as would justify the large expenditure involved. The company added that the matter would, however, be kept under notice and reviewed from time to time in the light of changing circumstances.

## Steam Turbines.*

It is now well understood that in steam turbine installations where steam economy is of prime importance, pressure compounding or the placing of many simple turbines in series on the steam flow, is essential; further, that one of the fundamental requisites for the attainment of high steam economy is the operation of the turbine at an appropriate overall velocity ratio, or ratio of mean blade velocity to steam jet velocity.

It is known from the laws of thermo-dynamics that the thermal efficiency of a heat engine depends chiefly upon the temperature range, that, in accordance with Carnot's principle, the temperatures at which heat is supplied and withdrawn should be as widely separated as possible. A large temperature range must necessarily be accompanied by a large pressure range. This is exemplified in the case of steam by the fact that the latent heat, which is a large proportion of the total heat, is absorbed during the process of evaporation, and in order that this may take place at a high temperature, the boiler pressure must be high. Accordingly, the expansion ratio in modern steam turbine practice is being increased, and in turbines under construction is in the neighbourhood of 1500 to 1. The corresponding temperature range is from about 470 deg. saturation temperature, raised to 750 deg. Fah. by superheating, down to about 75 deg. Fah., or a maximum drop of about 675 deg.

In modern turbine design, there arises the fundamental question of high steam velocities *versus* moderate or low steam velocities. From the point of view of reduction of the number of stages, and therefore the overall length of the turbine for a given capacity, it is clear that high steam velocities are all to the good, but in proportion as the steam velocity is increased, the essential benefit of pressure compounding is sacrificed, for the advantage of that principle does not rest solely on the fact that the hydraulic head under which each simple turbine of the series works, is reduced, but also on the evidence that the efficiency of conversion of the available energy of the steam into mechanical work in the nozzles and blading, increases as the velocity is decreased.

The high economy shown by the published test results of the Ljungström radial flow double rotation turbine which operates with higher steam velocities than are usual in parallel flow practice, has been attributed by some mainly to the reduction of steam leakage at the glands and dummies by means of a multiplicity of very fine labyrinth packings.

Recent researches in the laboratory, with fixed nozzles, but without blade rings, have confirmed that nozzle efficiency diminishes with increasing steam velocity, and it remains to find out the causes of this loss of efficiency, and whether it may be possible to reduce or eliminate it.

Apart from the effect of jet velocity upon nozzle efficiency, there is also the fact that the stage efficiency of a steam turbine is lower with saturated steam than with superheated steam. Laboratory tests have proved that the weight of steam discharged by a nozzle using steam initially dry-saturated is appreciably greater than that which theory would indicate, and it is thought by some that the cause of decreased efficiency of stages using saturated steam is closely connected with this phenomenon. It is thought, in fact, that the steam during expansion becomes super-saturated, and does not give up so much of its latent heat as it would do under conditions of thermal equilibrium, with the result that the available heat for a given ratio of expansion is considerably less than that indicated by calculation on the basis of thermal equilibrium. This question is closely bound up with the thermo-dynamics of steam turbine design. All engineers engaged in such work are desirous of reducing the nozzle and blading calculations to as nearly an exact science as possible, and of placing test results of different turbines under different steam conditions upon a rational basis of comparison. Up to the present, although a good approximation has been attained, this problem cannot be said to have been completely solved, the influence of cumulative heat arising from expansion of the steam with a stage efficiency less than unity, and the above-mentioned fact of decreased stage efficiency in regions where wet steam is found having much complicated the problem. With regard to the design of blading of the impulse type, there are two schools of thought. One of these favours the proportioning of the passages so as to obtain as far as possible what is known as "free deviation"—in which the blades are arranged so as simply to deflect the steam jets issuing from the nozzles, without alteration to the steam pressure. The other favours the employment of a certain amount of pressure drop in the revolving blade passages. The latter procedure is conducive to higher stage efficiency, but involves some leakage radially over the shrouding, and also circumferentially in the case of partial admission; in such cases the same principle is used as has for many years been standard in the case of reaction turbines, namely, the adoption of large radial clearances, but reduced axial shroud clearances.

The question has arisen as to whether a compromise between the so-called "impulse" and the so-called "reaction" principle can be made to give a higher efficiency than either principle alone, and it is interesting to note that impulse turbine builders and reaction turbine builders are approaching this question from opposite standpoints. At the present time reaction turbines are generally built with equal expansion ratio in the moving and guide rings of a reaction pair. Experiments have been made with a different division of the pressure drop, but up to the present, equal pressure drop in the fixed and moving blading and similar construction for these parts have given the best all-round results.

Advance in the direction of increasing the thermo-dynamic value of the heat in the steam without unduly increasing the maximum temperature, is being made by increasing the mean temperature of heat reception. One method of effecting this is the adoption of regenerative feed water heating, by using steam tapped off from successive stages of the turbine. The necessity to heat the feed water—that is, to re-heat the water of condensation—is the defect of the Clausius' cycle. If, however, a perfectly

* Abstract of paper read at the World Power Conference by Sir Charles Parsons.

regenerative process could be employed for heating the feed, the efficiency of the Clausius' cycle for saturated steam would be brought up to that of the Carnot cycle. In such a process the steam tapped off has been expanded, doing work in the turbine, down to the temperature at which it is required to heat the feed water. Since a certain amount of heat is required for this purpose in any case, the work obtained from the tapped off steam is obtained merely at the expense of additional heat equal to the work done, or, in other words, at 100 per cent. efficiency. Expressed in another way, the utilisation of some of the heat of the steam to heat the feed water reduces the amount of heat that is lost by condensation in the condenser.

A slight practical objection to such a system of feed-water heating is the additional complication of the pipe-work involved, if a sufficient number of feed-water heaters in cascade are employed to approximate to a thermo-dynamically reversible process; but even with two or

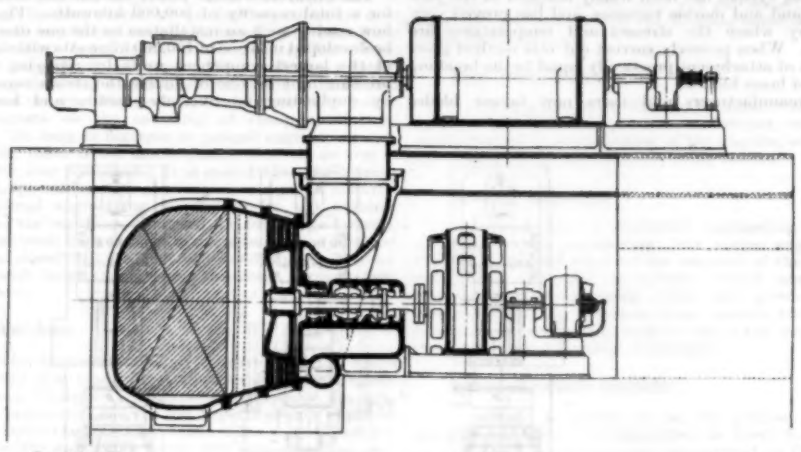



FIG. 1 SCHEME FOR THE UTILISATION OF HIGH VACUUM

three stages, very considerable heat economy can be effected. As a compromise, feed-water heating by steam extraction from a few stages of the turbine, in conjunction with economisers, is generally accepted practice in modern power stations, but there is a tendency to develop this system further so as to attain higher feed-water temperature by the steam heating. It then becomes necessary as an alternative or partial alternative to the economiser, to adopt some other means of absorbing the residual heat of the flue gases, such as a regenerative pre-heating of the air for the furnaces. Feed heating in a single stage by partly expanded steam is a well-known procedure. It was proposed by James Weir in 1876, by Normand in 1889, and in progressive stages by Ferranti in 1906. With marine turbines it is general practice to utilise the exhaust steam from the auxiliary engines, at a pressure slightly above atmospheric for this purpose. Similar use can be made in power stations of any low-grade heat that is available, such as in steam from turbine glands, ejector air pumps, &c.

As a second method of increasing the mean temperature of heat reception, an advance might be made if after superheat to the maximum temperature further heat might be added so as to maintain isothermal expansion throughout the initial stages of the turbine. This could only profitably be carried to such a point that subsequent adiabatic expansion in the turbine to the condenser vacuum would leave the steam just saturated. Such a method—of preliminary isothermal expansion—was proposed many years ago, but the mechanical difficulties in the way to its complete realisation would appear insurmountable. An approximate solution, however, is being worked out at the present time. In some installations the steam, after a certain amount of expansion in the turbine, is extracted and raised again to a high temperature in a reheater before re-entering the turbine. Reheating has also the additional advantage of extending the range within which superheat exists and of diminishing the range where moisture and consequent loss by water resistance or increased viscosity exists. This process might, of course, be extended to include reheat at various stages of the expansion. With a single reheat a compromise must be accepted when selecting the stage at which the steam is taken from the turbine. If reheating is carried out too soon, then the heat added—although at a high mean temperature—is only of small amount. On the other hand, if reheating is carried out too late, then the heat added—although of greater amount—is received at a lower mean temperature, so that the mean temperature of reception of the cycle is not much improved.

If a curve be drawn showing the estimated percentage gain in thermal efficiency on a base of the proportion of expansion carried out before reheating, it is found that there is a fairly definite peak indicating the most appropriate reheating point. The maximum estimated gain in the case of a single reheat to the initial temperature of 750 deg. Fah. is in the neighbourhood of 7 per cent.

Since reheating the steam increases the total available heat per pound, more blading is required in the turbine to maintain the same average velocity ratio. This and other considerations tend towards the desirability of carrying out the expansion in two or more separate cylinders, the exhaust steam from any one cylinder being reheated before entering the next. Where such reheating is adopted, special means must be provided to prevent overspeeding of the machine, owing to the large volume of steam stored up in the reheater and connecting pipes.

A third method of attacking the same problem is to increase the mean temperature of the heat reception by increasing the boiler pressure.

With a boiler pressure of 250 lb. per square inch, a final temperature of 750 deg. Fah. after superheating, and a feed-water temperature of 79 deg. Fah., the mean temperature of heat reception is about 360 deg. Fah. But if the boiler pressure is increased to, say, 2000 lb. per square inch, still superheating to 750 deg. Fah., then since the latent heat is received at the increased temperature of the boiler, the mean temperature is considerably increased, namely, to 480 deg. Fah. If, in addition, we assume the water is fed into the boiler at the boiling temperature by means of feed heaters in cascade in each case instead of at 79 deg. Fah., the mean temperature of heat reception is increased in the one case to 430 deg. Fah. and in the other to 680 deg. Fah.

Whilst such a pressure as 2000 lb. per square inch has not been actually adopted in any commercial plant, there seems to be no reason why it should not be practicable in a large steam turbine installation. In such a case there may be a small auxiliary high-pressure turbine, having several stages of small diameter, running at high revolutions, and after dealing with the first few expansions, exhausting into the turbines working at ordinary pressures. Such high-pressure turbines are actually being built, one in this country for a pressure of 1500 lb. per square inch and one in the United States of America for 1250 lb. per square inch.

With regard to the lower end of the temperature range, the temperature of the cooling water here imposes the limit. An exhaust vacuum equivalent to 29.25in. of mercury (barometer 30in.) can be realised under favourable circumstances. This, however, involves the necessity of providing ample blade area and passageway for the great volume of low-pressure steam.

Throughout the stages of a turbine, the criterion of efficiency is the velocity ratio, and the areas of the blade passages successively increase in such proportions as to provide the proper ratio between the blade velocity and the steam velocity. The axial component of the steam velocity is carried on from stage to stage without appreciable loss. It is even built up to higher values as the peripheral and steam velocities increase. Its final loss at the exhaust end of the turbine, however, is practically unavoidable, and with the high peripheral speeds adopted in most low-pressure blading at the present day, an exhaust blade area which gives a perfectly satisfactory velocity ratio may entail a loss of energy in the issuing steam of considerable amount. Such loss is augmented if, for the sake of weight or cost, any sacrifice is made of the final velocity ratios, which sacrifice might otherwise be a perfectly justifiable compromise. It is evident therefore that the exhaust end of a turbine requires separate treatment in its design from the point of view of limitation of the leaving loss; that is, the energy lost in the issuing steam.

Broadly speaking, where high efficiency is the aim, this consideration imposes a limit upon the axial velocity of the steam in the final annulus. For a given vacuum therefore the area of the final annulus must increase in proportion to the output, and for a given output any increase in the vacuum involves an increase in the area of the final annulus. It will be seen therefore that any effort to extend the steam cycle by lowering the temperature of condensation, brings at once into prominence the problem of the exhaust end.

Various expedients have been adopted for the purpose of surmounting this limitation. One method, commonly employed in both land and marine turbines, is to carry out the final stages of the expansion by divided flow, as, for example, in a double-ended low-pressure turbine, the steam entering at the middle and flowing in each direction towards an exhaust at each end. In such an arrangement, two exhaust pipes are provided and frequently two condensers. In another example of divided flow, some makers double only the last row or last few rows of blading, employing specially shaped passages to conduct the steam to the divided portion from the preceding stages.

The design of exhaust end advocated by Baumann is another attempt to overcome the same difficulty. In this device, instead of carrying over a part of the steam by special ports to additional blade rings, it is made to flow through inner annuli of the preceding blade rings, the vanes of these inner annuli being specially shaped to reduce the resistance involved to a minimum.

The area of the final annulus can be increased by increasing the blade height, and any means of extending the height permissible on a given diameter is valuable for this purpose. Thus in many turbines, the blades of the last stages are made of varying section and discharge angle, permitting a greater length ratio without unduly increasing the stress.

If no limit is imposed upon the diameter of the exhaust end or upon the revolutions, the simplest and probably

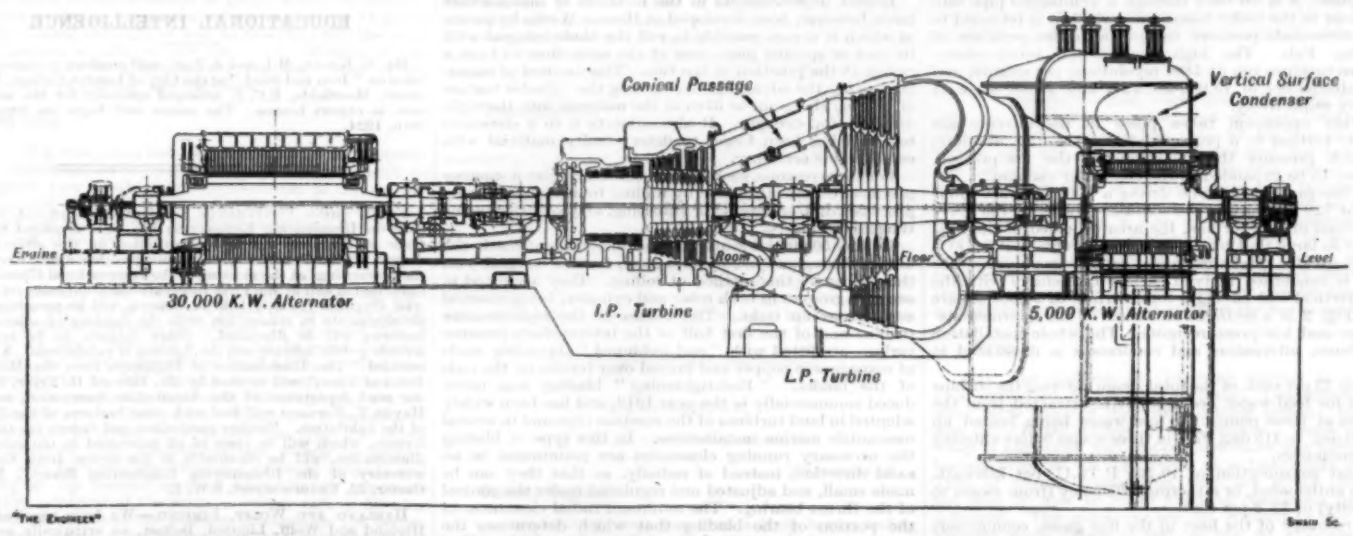



FIG. 2—SECTIONAL ELEVATION OF INTERMEDIATE-PRESSURE AND LOW-PRESSURE TURBO-ALTERNATORS OF 50,000 K.W. PLANT

best solution of the exhaust area problem in large machines, is to provide a separate low-speed turbine of large diameter for the final stages of the expansion, having blades of normal profile throughout, and correspondingly high efficiency. This low-speed turbine can be arranged in close proximity to the condenser—as illustrated diagrammatically in Fig. 1—so as to reduce to a minimum both the length and the resistance of the exhaust passages.

In the exhaust passage itself, it is not sufficient to provide area to reduce the mean velocity of the steam passing through it to a moderate value, but the exhaust steam must be distributed into the passage uniformly, so that the velocity is everywhere nearly the same. Neglect of this requirement leads to unnecessary hydraulic losses, and may also cause troublesome blade vibration in the final stages.

Many attempts have been made to obtain the benefit of the diffuser principle, which has been so commonly adopted in the case of water turbines, but in the case of steam

turbines without substantial success. In any attempt to carry this principle into effect, ample exhaust pipe area should be provided, with progressively larger cross-section as the condenser is reached, so that the exhaust steam from the last row of revolving blades is gradually slowed down, with a possible recovery of static pressure.

The practical difficulties in the way of such recovery of pressure in the exhaust steam are very great, and the best that can be done in this direction would appear to be to utilise the leaving velocity of the exhaust steam to overcome the resistance to flow in the exhaust passages, so that the absolute pressure at entry to the condenser is the same as at the exit from the blading.

Summarising the foregoing, there are four methods of improving the thermal efficiency of the thermo-dynamic cycle without going to higher maximum temperature :—

(1) Increased feed-water temperature, with regenerative heating of the feed water by steam drawn from the turbine.
(2) Increased boiler pressure.
(3) Reheating of the steam after partial expansion.
(4) Increased vacuum and means to utilise it effectively.

An application of these principles is made in the turbine plant of 50,000-kilowatt normal capacity to be erected in the new Crawford-avenue power station, Chicago, and now nearing completion at Newcastle-on-Tyne. In this plant there are three cylinders in series on the steam flow, each driving an alternator, the three alternators being electrically coupled in parallel.

Steam is generated at 600 lb. pressure and supplied to the stop valve of the high-pressure turbine at 550 lb. pressure, superheated to 750 deg. Fah. After expansion in the high-pressure turbine to a pressure of 100 lb. above atmosphere, it is led back through a well-lagged pipe into a reheater in the boiler-house from which it is returned to the intermediate-pressure turbine at a temperature of 700 deg. Fah. The high-pressure and intermediate-pressure turbines run at 1800 revolutions per minute, and drive alternators of 15,000-kilowatt and 30,000-kilowatt capacity respectively.

Further expansion takes place in the intermediate pressure turbine to a pressure of about 2.0 lb. absolute, at which pressure the steam enters the low-pressure cylinder, to be expanded to the condenser vacuum.

The low-pressure turbine drives a 5000-kilowatt alternator at 720 revolutions per minute. Owing to the lower revolutions of this turbine, the area provided in the final stage is so large that blades of normal profile, but set at a slightly greater discharge angle, can be employed. The steam is condensed in twin surface condensers with the tubes vertical and having a total surface of 56,000 square feet. Fig. 2 is a sectional elevation of the intermediate pressure and low-pressure units. The whole installation of turbines, alternators and condensers is illustrated in Fig. 3.

About 22 per cent. of the total steam entering the turbine is used for feed-water heating. It is extracted from the turbines at three points, the feed water being heated up from 65 deg. to 315 deg. Fah. in three stages before entering the economisers.

A heat consumption of 10,265 B.Th.U. per kilowatt-hour is anticipated, or a thermal efficiency (from steam to electricity) of 33.2 per cent.

For recovery of the heat in the flue gases, economisers are used for a final stage of feed-water heating, and air pre-heaters, a regenerative process being employed in the latter to heat up the incoming furnace air.

The boiler plant is expected to have an efficiency of 86.5 per cent. After allowing about 3 per cent. for the total power absorbed by the auxiliaries, an overall thermal efficiency (from coal to electricity) of 27.80 per cent. is anticipated. This is on the basis of a boiler pressure of 600 lb. per square inch. A schedule is given in the Appendix [not reproduced] of the thermal efficiencies it is estimated could be realised with high boiler pressures, up to 2000 lb. per square inch.

Some details of the turbines and alternators will be of interest.

The three cylinders contain sixty-four simple turbines arranged in series, the first having blades 2½in. long and ¾in. wide on a mean diameter of 30½in., and the last having blades 40in. long and 5¾in. wide on a mean diameter of 160in.

In view of the low density of the steam, the passages from the intermediate-pressure turbine onward have been specially designed to have the minimum of resistance and to avoid any sudden enlargements which would produce eddies or shock. The intermediate-pressure turbine discharges its steam directly into the low-pressure turbine through a conical annular space surrounding the intermediate bearings, and the energy of the leaving velocity of the intermediate-pressure exhaust is thus conserved—see Fig. 2.

The maximum blade tip velocity is reached at the last ring of the intermediate-pressure turbine, where it is 760ft. per second; in the low-pressure turbine, which runs at 720 revolutions per minute, the maximum tip speed is 626ft. per second.

On the constructional side the most important feature of a turbine is its blading. There is probably no other part upon which so much ingenuity has been expended, and there are wide differences in practice, both as regards materials used and the methods of manufacture and of attachment. The best known system is that in which the blades are made of rolled brass strip fixed into the rotor or casing by caulking spacing pieces between the blade roots. This system has been widely adopted in the past for both land and marine turbines, and has proved very satisfactory where the stresses and temperatures are moderate. When properly carried out this method gives a strength of attachment practically equal to the breaking strength of brass blades.

Many manufacturers and users now favour blades integral with their roots, and with such a formation higher stresses can be employed with suitable material. Such integral blades have until recently been formed by milling from the solid bar.

The roots are machined to suitable shapes or are serrated, and attachment is effected by driving up the combined pieces in accurately machined or serrated grooves or slots.

Recent improvements in the methods of manufacture have, however, been developed at Heaton Works by means of which it is now possible to roll the blade integral with its root or spacing piece, and at the same time to form a radius at the junction of the two. This method of manufacture has the advantage of retaining the valuable feature of putting the grain or fibre of the material into the right direction for strength. It also subjects it to a strenuous test and has been found to detect faulty material with considerable certainty.

For these reasons, such methods of rolling give a superior product to that attainable by milling from the solid or by processes of drop forging or stamping, and are at the same time less costly.

In the 50,000-kilowatt turbine above mentioned, the blades throughout are of mild steel, formed integral with their roots by this method of rolling. They are fitted in serrated grooves in both rotor and cylinder, being inserted and driven up tight. The blades of the high-pressure turbine and of the first half of the intermediate-pressure turbine are fitted with "end-tightened" shrouding made of manganese copper and brazed over tenons on the ends of the blades. "End-tightening" blading was introduced commercially in the year 1912, and has been widely adopted in land turbines of the reaction type and in several mercantile marine installations. In this type of blading the necessary running clearances are maintained in an axial direction, instead of radially, so that they can be made small, and adjusted and regulated under the control of the thrust bearing. The minimum radial clearances of the portion of the blading that which determines the position of the turbine shaft axially in its cylinder. The minimum radial clearances of the portion of the blading that is end-tightened is ¼in., whilst the radial clearances in the remainder of the blading range from ¼in. up to ¾in.

Each turbine shaft is fitted with an emergency governor, and these are interconnected so that any one of them will trip all steam admission valves simultaneously and at the same time open a large vacuum breaking valve. In order to meet the special conditions that arise when reheating is adopted, the governing of the turbine has been arranged so as to avoid any danger of over-speeding due to stored steam. This is done by the provision of an independent governor valve on the inlet to the intermediate-pressure turbine, which receives steam from the reheater. The governor controlling this valve is set to operate at a speed about 2 per cent. in excess of that of the main governor, and with this lag will control the rate of steam admission to the intermediate-pressure turbine whenever the load on the plant is suddenly reduced. In case this valve should close for any reason whilst the main high-pressure inlet remained open, a relief valve of ample area is provided on the exhaust pipe of the high-pressure turbine, and set to open at 130 lb. per square inch above atmosphere, whilst an increase in pressure to 140 lb. will operate an additional tripping device and shut off the main steam supply.

The alternators are wound for a three-phase supply at 13,000 volts, and embody the latest British practice. No main field regulators are used in their operation, the regulation being carried out by means of well-designed exciter field rheostats.

The ventilation is effected by means of the closed circuit system employing surface air coolers and separately driven fans, which have a much higher efficiency than high-speed fans integral with the rotor shaft.

The stator frames are being built in one piece, and the alternators are to be shipped completely wound.

Since when starting up the plant, there will be insufficient steam to drive the low-pressure turbine, the alternator coupled to this turbine will be run up as a synchronous induction motor. The three alternators will then be synchronised together and operated as one unit, giving a combined normal output of 50,000 kilowatts.

The Crawford-avenue power station has been laid out for a total capacity of 500,000 kilowatts. Fig. 4 shows how readily such an installation as the one described can be developed into one of 100,000 kilowatts without increase of the largest component units by replacing the high-pressure unit by one of double the steam capacity, and by duplicating intermediate-pressure and low-pressure units. There would thus be three alternators of 30,000-kilowatt output and identical designs, and two smaller alternators of 5000-kilowatts driven by the low-pressure turbines.

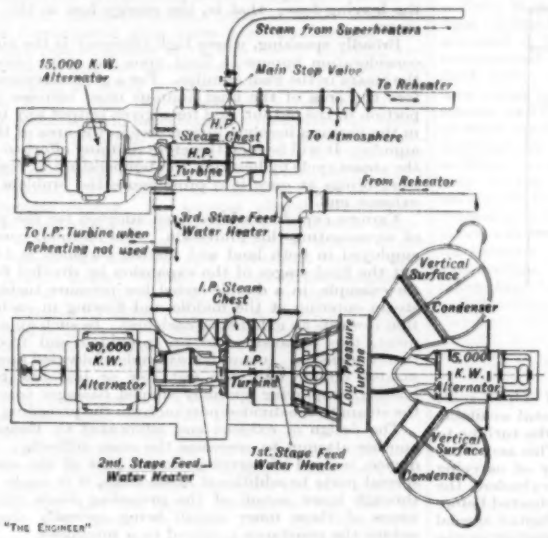



FIG. 3—50,000 K.W. TURBO-ALTERNATOR PLANT AND CONDENSERS

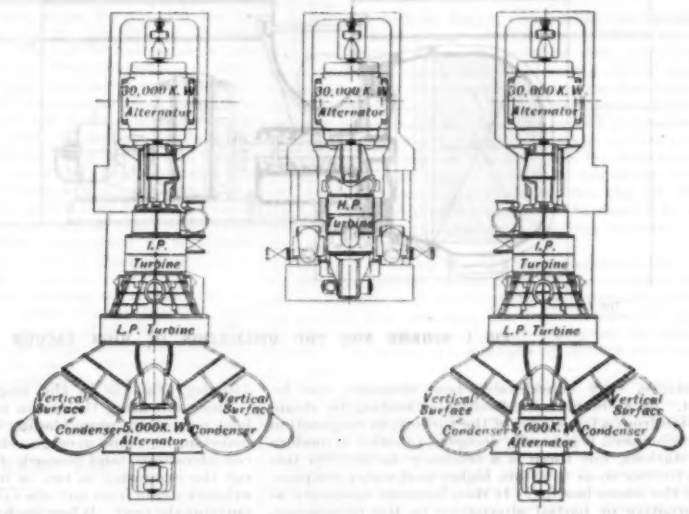



FIG. 4—ARRANGEMENT OF 100,000 K.W. INSTALLATION

## EDUCATIONAL INTELLIGENCE.

MR. B. KELLY, M.I. and S. Inst., will conduct a course of lectures on "Iron and Steel" at the City of London College, White-street, Moorfields, E.C. 2, arranged specially for the needs of men in export houses. The course will begin on September 30th, 1924.

FORTHCOMING CONFERENCE ON ILLUMINATION.—A Conference on Illuminating Engineering has been arranged to take place at the British Empire Exhibition on the afternoon of August 12th, 2.30 to 5.30 p.m. Amongst other items, a report of the proceedings at the meeting of the International Illumination Commission and at the First International Conference on Industrial Hygiene, recently held in Geneva, will be presented, and developments in connection with the lighting of schools and factories will be discussed. Other subjects to be reviewed include public lighting and the lighting of exhibitions. A paper, entitled "The Illumination of Highways from the Motorists' Point of View," will be read by Mr. Edward H. Fryer, head of the road department of the Automobile Association, and Mr. Haydn T. Harrison will deal with some features of the lighting of the exhibition. Further particulars and tickets for the Conference, which will be open to all interested in the subject of illumination, will be obtainable in due course from the hon. secretary of the Illuminating Engineering Society, Mr. L. Gaster, 32, Victoria-street, S.W. 1.

HARLAND AND WOLFF, LIMITED.—We have received from Harland and Wolff, Limited, Belfast, an artistically arranged and well-printed souvenir booklet showing the advances which the firm has made in the building and repairing of marine Diesel engines of the Burmeister and Wain-Harland and Wolff type. The advantages of the motor vessel are set forth, and illustrations are given of the different types of standard marine oil engines and auxiliaries constructed by the firm. We note that the various types of engine include single-acting four-cycle engines, up to 4000 indicated horse-power for single-screw ships and to 8000 horse-power for twin-screw vessels, while these figures are 4500 and up to 40,000 indicated horse-power with the new double-acting four-cycle engine. Installations having a total indicated horse-power of 60,000 and 80,000 are contemplated with triple and quadruple arrangements of the double-acting engine. Engravings of the most notable motor vessels built and engined by Harland and Wolff, Limited, are contained in the booklet, and we note that 126 ships, with a gross tonnage of 721,546 tons, have been completed since 1912. The latter part of the book is devoted to illustrations of the firm's shipyards at Belfast, Govan and Greenock, and the engine works at Belfast, Finneston and Scotstoun. Several views of the Clyde Foundry at Govan are given, and illustrations of the well-equipped ship and engine repairing works at Southampton, Liverpool and North Woolwich (London) are also reproduced. The booklet is a worthy souvenir of the leading part played by the firm in the construction of British motor ships.

# Provincial Letters.

## THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

### The Holiday Period.

Business has been so bad in the iron and steel trades of the Midlands and Staffordshire of late that manufacturers welcome the arrival of the holidays, and are in many cases closing down for a more than usually lengthy period. They are hoping that in the interim orders will accumulate, and are taking the opportunity to repair plants, &c., in anticipation of the autumn demand. Unfortunately, it must be admitted that prospects do not grow appreciably brighter. Some districts are more favourably placed than the Midlands, but the industry as a whole remains depressed, and the depression is aggravated by the excess of productive capacity over what may be considered normal demand. For some time now the busiest firms in the Black Country have been operating only about half time. Many mills have closed down altogether, and others have run single mills to deal with casual orders. Many of the firms have been forced to concentrate on the re-rolling of cheap continental material. So long as business in general engineering continues slow, there is not much chance of a real revival of demand for iron and steel. It is stated that engineering firms with special lines are showing more signs of activity. Constructional engineering is affected by the building strike, and the contracts tendered for for bridge building and similar work have not yet materialised. The Midland engineers, moreover, are severely handicapped in competition with large concerns on the coast through high railway rates.

### Finished Iron.

The dulness which has characterised the South Staffordshire iron trade for a considerable period shows no tendency to depart. Ironmasters generally are anything but optimistic, and are not hopeful of any improvement until after the holidays. Some of the largest Staffordshire ironworks are closing down, and have dismissed part of their regular staff. Operations in the Black Country are chiefly restricted to the re-rolling of steel bars, largely from Belgian material. Where iron and steel come into competition, the relatively low prices of steel turn the scale in its favour. The nut and bolt industry furnishes a case in point. There is only an insignificant demand for common bar iron, the price of which remains at £12, against Belgian quotations of £8 to £8 5s. Most of the South Staffordshire forges are idle. The holidays in Scotland have practically suspended the shipbuilding industry, and this has affected the local chain and nut and bolt industries, in which very little work is being done. Makers of marked bars are still able to command £15 per ton. Crown quality unmarked bars are offered at £13. The Staffordshire works have not followed the rise of 10s. in South Yorkshire, where the quoted price is £13 10s. They find it almost impossible to get business on the £13 basis.

### Galvanised Sheets.

Galvanised sheets continue active, makers having orders sufficient to occupy them for some months. The demand for the thinner gauges is most in evidence, leading makers being unable to accept 30-gauge orders for delivery in August. Orders for galvanised corrugateds of 24-gauge are not coming through so well as recently, but the price is maintained at £18 5s. per ton, f.o.b. Makers of tinplates are also in a satisfactory position, most of the foreign buyers placing new business.

### Pig Iron.

Pig iron prices have weakened further, and speculative influences have come into play. It is difficult to distinguish how much of the depreciation is due to unloading, and how much to readjustments by producers. Foundry pig has changed hands at something like half-a-crown less than the price makers quoted a week ago. A few of the sales may have been exceptional, but it is also certain that many furnacemen have submitted to the altered position, and themselves made substantial concessions in the hope of getting a share of the orders going. North Staffordshire forge is quoted £4 5s., and No. 3 foundry £4 10s., Derbyshire forge £4 5s., and foundry £4 7s. 6d.; for Northamptonshire forge £4 5s. is asked, and for foundry £4 2s. 6d. In the Manchester market the latter iron is competing both with Cleveland and Derbyshire brands at the lower rate. There are a number of furnacemen who refuse to entertain the very low prices which some of their competitors are willing to accept. Hardly any furnaces are disposing of their output, and stocking at the present cost of labour is an expensive operation. Several of the furnace owners talk of blowing out their plant unless the position changes for the better. The export trade is decidedly slow, the July shipments comparing unfavourably with those of last month. Fortunately, pig iron makers are getting a little relief in their cost of coke, furnace fuel now being obtainable at £1 at the furnaces, giving a saving of several shillings per ton over prices early in the year. The advantage of this reduction will be considerable when a revival takes place. Some merchants are speculating on the chance of stronger conditions developing between now and September.

### Steel.

Business in the steel trade continues unsatisfactory, demand being very poor. The opportunity is being generally taken to get holidays out of the way, and execute any repairs that call for attention, by way of preparing for the more active trade which optimists look for later. It is the rule for September to introduce a little recovery, and most people look for more activity in the autumn. The finished steel trade is affected by Belgian competition, mild steel bars being obtainable at £6 10s. Antwerp and joists at £6 6s. 6d. Birmingham merchants are taking advantage of these low prices to execute orders by shipments from Antwerp direct to foreign destinations. As a result, most native steels can be shaded in price. While the nominal figure for joists is £9 15s. to £10, most firms are willing to accept £9 12s. 6d. For small steel bar £10 is generally asked, but that figure is shaded, £9 15s. to £9 17s. 6d. being accepted. Belgian shippers will sell at about £8. Re-rollers are very poorly off for business. Continental hoops are offered at £8 10s., deliveries being promised within six to eight weeks. The Staffordshire quotation of £12 is shaded by some producers. Steel plates are being sold at £10 5s. Semi-finished steel is a keen market. Native billets are offered at £7 15s.; Belgian billets can be bought at £6 15s. One large consumer states that he had been offered Luxemburg billets at £6 10s. delivered. Mild steel scrap has depreciated, being now offered at £3 18s. to £4 per ton.

### Germany Active.

Germany appears to be doing an increasing business in bright rolled strip and galvanised and other kinds of wire, underselling the Midland material by something like £2 per ton.

### Steel Works Dispute.

The position at Messrs. Hickman's steel works, Spring Vale, Bilston, remains unchanged, and at the moment there is no indication of the dispute, which led to the closing of the entire plant, being settled.

### Coventry Industries.

Trade in the Coventry engineering industries continues to be satisfactory, but motor engineers are waiting to see the effect of the removal of the McKenna duties upon the light car industry before launching the next season's programmes, which had previously been contemplated. At the same time, current business continues to be satisfactory, and in only a few instances has there been any slackening of demand.

### New Staffordshire Coalfield.

What is spoken of as the greatest industrial development which has taken place in North Staffordshire for at least half a century was inaugurated on Wednesday, when the Duke of Sutherland cut the first sod at the sinking of a new colliery at Hem Heath, Trentham, for the Stafford Coal and Iron Company, Limited. It is a great undertaking, for 2345 acres of coal and ironstone are to be worked. Ninety million tons of coal and 15 million tons of ironstone are to be recovered, and when the work is completed in about six years' time, employment will be found for at least 4000 men. One shaft is to be sunk immediately on the Longton side of Trentham railway station, and later it is proposed to sink a second shaft in close proximity. The scheme will involve a capital expenditure of more than half a million pounds.

### Old Hill's Flooded Mines.

There is a prospect of a revival during the next few months of the mining industry in the southern portion of the Old Hill area, in consequence of the progress made by the new pumping machinery at Waterfall-lane, Old Hill. The machinery, which was installed by the Old Hill Mines Drainage Commissioners, has been working at high pressure night and day, pumping water from the flooded pits at the rate of 426 gallons per minute, and though there is still a vast accumulation to be dealt with, the position is looked upon in official circles with considerable optimism. It is now more or less a matter for the mineowners in the district to take advantage of the operations of the Drainage Commissioners, and endeavour to resuscitate the mining industry of the neighbourhood.

### Unemployment.

There is a slight increase in the number of persons unemployed in the Midlands. Returns issued by the various unemployment exchanges show that for the week ended July 21st the number of persons out of work was 131,297, as compared with 131,084 for the previous week, an increase of 213. In the Birmingham area the number now out of work stands at 30,796; Bilston, 4355; Coventry, 2939; Cradley Heath, 4288; Dudley, 4154; Oldbury, 1681; Smethwick, 4139; Stourbridge and Brierley Hill, 3665; Tipton, 2132; Walsall, 5294; West Bromwich, 2915; Wolverhampton, 5774; and Worcester, 1419.

## LANCASHIRE.

*(From our own Correspondents.)*

Manchester.

### General Outlook.

Although there has been a little better feeling in the non-ferrous metal markets this week, the improvement has not extended to iron and steel; and if there is to be any real improvement in trade it ought undoubtedly to begin on the side of iron, and extend to the metals later on. Any other apparent commencement certainly suggests that the spirit of speculation and not the spirit of industry is at work. Of course, it may be said that in the case of copper a low level of prices and the probability that no further fall can take place give a better reason for improvement than in the case of iron; for the latter is still substantially above pre-war averages of prices; but this excuse cannot be given in the case of the other metals. It is probably wise to look with suspicion upon any upward movement until the conditions of trade and industry are much better.

### Metals.

There is a certain speculative movement in the American Stock Exchange in favour of copper, and this seems to have given a slight fillip to the market here. Wall-street may be right, of course, but the position of copper is likely to be damaged rather than helped by the absurd statements made with a view of supporting an upward movement. When these statements imply that the consumption of copper is about four times as great as it has ever been in the history of the trade, it is clear that they are for the consumption of the gullible outsider and not for those who are acquainted with the trade. With the absence of any official figures as to stocks, we are left in doubt as to the actual statistical situation, but it is generally believed that this is no more favourable than it was. In the Manchester market there has been a little more disposition to buy copper, but the actual business passing is not yet good. For one thing, engineers here are not very well off for work, and are not using the usual quantity of copper. This, of course, tends to keep down the local consumption; and the better buying noticeable is probably for future requirements, and in view of the fact that copper prices are not likely to be much lower whatever happens; while if the present Conference succeeds in settling the German trouble, and getting the loan through, some considerable part of the money may be spent in copper, for which there is no doubt very urgent need in Germany and Central Europe. Members of the trade in old metals here do not yet show any expectation of higher prices for copper. The prices they offer for the alloys, gun-metal and yellow brass scrap are still as low as ever. For old gun-metal £46 per ton is offered here, and that price was offered when copper was £2 cheaper and tin was £40 cheaper than they now are. The lack of demand for this cheap gun-metal is one of the curious features of the situation. The market for tin has been rather jumpy; but that was to be expected. The point to be noted is that there has been an advance of over £40 per ton from the bottom, but no corresponding improvement in the actual position. Buyers of tin seem to be basing their expectations on the considerable increase in the American demand. It would, of course, be very rash to prophesy either way, but certainly caution is needed in this market. Lead and spelter have both been firm, and the long anticipated reaction in lead prices seems as far away as ever. Nevertheless, supplies of lead are coming in fairly well, and although cable makers are taking large quantities, the building trade demand is falling off.

### Pig Iron.

The market here for foundry iron seems to be duller than ever. One hears of small transactions, but very seldom of any buying of importance; and when that is heard of it is at prices which startle the whole community of pig iron buyers and sellers. One of these transactions was forced through by a concession which was nearer 5s. than 2s. 6d. per ton, and, of course, affairs of this kind do no good to the market. They suggest financial pressure; for nothing else can account for such "alarming sacrifices." As a general rule, sellers of Derbyshire No. 3 iron quote 97s. to 97s. 6d. per ton delivered in Manchester, but it might be possible to get them down to 96s. At this latter figure some Lincolnshire No. 3 has been sold here; but, of course, the Lincolnshire makers are selling No. 3 only because they cannot sell their basic iron. So soon as the demand in the steel-making qualities revives then no doubt Lincolnshire furnaces will have no No. 3 to sell; and the ironfounders, who have been again getting accustomed to the use of it, will be compelled to go back to Derbyshire or to Staffordshire iron. Sellers of Scotch pig iron seem rather weak again; and although there was a positive affirmation that Scotch makers would not allow the price to fall below 95s. at the furnaces, No. 3 of good brands has been offered here at a delivered price which would mean 2s. 6d. less at the works. East Coast hematite iron is also very weak and slightly cheaper here than the cheapest Scotch.

### Steel.

Agents for steel works are still trying to maintain the prices for manufactured material, and do not admit that they accept less than £9 10s. for joists and angles, and £10 for common plates and flat bars; but one has one's doubts. It is certain that almost all the works are very short of orders, always with the exception of sheets, which in any case do not amount to a very heavy tonnage; and it may generally be assumed that when a steel-making establishment is short of work it is squeezable in the matter of prices. Of course, sales of steel below the ostensible prices are kept very quiet; and the only way to find out the best that can be done is to send a good order round and see what the works say to it.

### Scrap.

The dullness in the scrap market is a fairly good indication of the state of trade. Consumers would want more scrap if they were getting orders; but it is now exceedingly difficult to find buyers. Steel melting scrap is neglected, and dealers here have put down their buying price to 70s. on trucks at a Lancashire station. This, of course, means that they are afraid they will not long be able to make Sheffield consumers pay 85s. delivered. The ironworks are not inclined to buy heavy wrought scrap unless at 90s. or 92s. 6d. delivered, and dealers rather resent this figure when bar iron is still ostensibly at £13 per ton. The foundry trade here is very quiet, and but few inquiries for cast scrap are in the market. For the best lots of textile cast scrap Manchester dealers still ask 90s. per ton delivered; and as Scotch iron is at least 18s. dearer the price is reasonable enough; but for ordinary cast scrap 85s. would be taken. There is, of course, too much cast scrap on the market and very much too small a consumption.

### Manchester Gas to be Sold by the Therm.

The Manchester Corporation Gas Department is about to adopt the therm as the basis for charging for gas in place of the older system, "per thousand cubic feet." The Corporation has given notice that the calorific value of the gas which it intends to supply is 450 British thermal units per cubic foot. The charge will be 8·44d. per therm, subject to a discount for prompt payments of a halfpenny per therm. The price hitherto charged was three shillings and twopence per 1000 cubic feet to consumers of under 20,000 cubic feet per quarter.

### The Holiday Season.

The holiday, or "wakes," season in Lancashire is now in full swing, and in spite of the bad times which both the textile and engineering industries are experiencing, involving much unemployment, large sums of money have been saved by the operatives in the manufacturing towns, with which they intend to have "a good time," either at Wembley or the seaside. Some idea of the money accumulated in the savings clubs can be gathered from the figures given with regard to the town of Royton, where the state of unemployment has been very bad during the year. It is said that the amount saved in this town is equivalent to £2 per head of the entire population. About £35,000 will be distributed by the clubs this week-end, and by the end of another week the bulk of this will have changed ownership. Manchester has no official wake week, but the first week in August is not one in which I should advise travellers to visit this district on business.

BARROW-IN-FURNESS.

### A Quiet Hematite Market.

There is nothing fresh to report regarding the hematite pig iron trade here, which appears to be experiencing conditions similar to those in other iron districts. If it were not for the fact that the steel departments are big consumers of iron there would be a restriction of output, for no maker is willing to accumulate stocks in these times. The orders which are being placed are for small parcels just sufficient to meet the present-day requirements, customers preferring to order in that way probably in the hope that the price will come down. It is rather a forlorn hope, for it is generally admitted by those who are in a position to know, that the margin of profit at present is very small, if there is any at all. What can happen to bring down the price of iron? Wages are controlled, and there is no chance of their being altered. Fuel is dear and largely affects the price of iron, but what chance is there of fuel becoming cheaper? Railway rates are stiff and bear on the cost of iron generally, but there seems very little hope of their being further reduced. Look in what direction one cares to, there does not appear to be any chance of prices being lowered. Certainly the foreign exchange is operating against local hematite iron, and there will not be much continental trade or trade with other countries which are not buying from us owing to the benefits they are deriving through the franc standing at 86 in France and 95 in Belgium.

### Iron Ore.

The iron ore trade is dull and is likely to remain so, it being governed entirely by the state of the iron market, for little ore is going out of the district. None of the mines are active, but those in Cumberland are bringing up the most. Some mines can hardly be said to be at work, for there is a restriction of output all round. The business being done in foreign ores, particularly Spanish, is not great, and the imports are down at a low figure.

### Steel.

The steel trade is in only a poor way. There are not many orders to be obtained, and the competition is keen. There is left no margin of profit for makers at present prices. The rail mills at Workington have not got regular work. At Barrow the rail mills are still working; the merchant mill is idle, but the hoop and small section mills and the foundries are working. The latter are moderately placed for orders.

### Shipbuilding and Engineering.

Vickers are making splendid progress with the big Orient liner Orama. Despite set-backs in the shape of disputes, little or no delay has occurred, and it is hoped to deliver this vessel by November. If that be done Barrow will have great reason to congratulate itself. The masts are in place and the funnels will be in very shortly. Many of the shipbuilders and engineers who went to America when work was scarce in Barrow are coming back. This may be due to various causes. There was, on the whole, very little difficulty for skilled men to get billets across the water; in fact, the competition at one time was very keen for them, but altered conditions of employment did not suit some, and then, of course, there was the fact that families remained here and could not get across to America owing to the stringent regulations.

### Steel Castings.

Vickers Limited have just installed at their Barrow-in-Furness works a new open-hearth Siemens steel furnace of the very latest type, built and designed by Wincott's, of Sheffield. The capacity is between 10 and 20 tons per heat, and it is now possible to get a total output from the steel foundries at the Vickers Barrow works up to 300 tons of steel castings per week, ranging from a few pounds weight each to a 20-ton casting. The first heat was tapped from this furnace on July 18th with very successful results, as determined from the test figures and analyses.

## SHEFFIELD.

*(From our own Correspondent.)*

### Heavy Steel Trade.

THE open-hearth furnaces are still finding conditions extremely depressing, for buyers are keeping out of the market and are displaying an indifference which augurs badly for the immediate future. The prospects are certainly most unpromising, the general demand for both acid and basic steel being weak and far below output capacity. If there is any consolation to be derived from the position, it is that for the past week the decline seems to have stopped, and for the present conditions are about stationary. Railway steel is in fair demand, but orders are running out, and it is not probable that they will be immediately replaced on the same scale. The Sheffield Chamber of Commerce, which keeps very closely in touch with trade conditions abroad, announces that there are prospects of another revival on foreign and colonial accounts shortly, as some big railway schemes are under advanced consideration in India, Australia, South Africa and Canada, among the British Possessions, and Roumania, Spain, Finland, Brazil and the Argentine among foreign states. In view of the long period of depression in the overseas market for Sheffield railway material, this optimistic forecast is particularly pleasing. As a result of the improvement in the shipbuilding areas, more activity is to be seen in those works producing marine castings and forgings, and shipbuilding steel generally.

### Medium and Lighter Sections.

Those departments making steel for motor vehicles continue to be actively employed, and though some persons are inclined to be dubious about the future position, there are no signs at present of any material easing off. A certain amount of cautiousness is being displayed, but as foreign competition is now not a serious factor, it is not safe to venture into definite prophecies. The local tool trades remain steady, and in spite of the wave of trade depression, which usually finds a reflection in the tool trades, the position is being quite well maintained. It is, of course, nothing to wax enthusiastic over, but all things considered, the position may be said to be satisfactory, with one or two features which give cause for optimism. Foreign rivals are taking a back place, and Sheffield manufacturers have proof that old customers are returning to the city. They deserted it in favour of centres which could produce an article of apparently the same quality and at a very much lower price than the Sheffield product. Time has shown them that the latter is far superior in quality, and does its work more efficiently, and in the long run proves more economical. The Dominions are buying well in Sheffield, and the inquiry clerks are being kept busy. Files, saws, picks, shovels, wire, electrical apparatus and mining and quarrying machinery are attracting most of the business. Prices are not as good as the makers would like, but they are not as bad as those ruling in the heavier industries, which in some instances fail to cover the production costs.

### Cutlery and Plate.

Business in the cutlery and plate branches is keenly competed for, and prices generally are cut to a very fine figure. The output continues to improve. The great—almost the sole—demand to-day in table cutlery is for the stainless variety. Pen and pocket knives have brighter prospects as a result of the present inability of the German makers to quote competitive prices impossible for Sheffield. This was the condition that ruled for a long time. It had disastrous effects upon the Sheffield trade, and though there are still large stocks of the Solingen-made articles, both in this country and abroad, Sheffield makers are in a more favourable position than for many months. This, unfortunately, does not apply to the once-prosperous razor trade. It registers spasmodic improvements, but the inevitable set-back occurs, and there are many cases of razor craftsmen who have not worked for several years. The silver trade is in a quiet state. Most of the business in electro-plated articles is for the cheaper grades, but an improvement is noticeable in the orders arriving for high-class goods. Britannia metal ware proves relatively cheap, and is commanding an increasing popularity. Sheffield is concerned over the fact that table knives and all silver-plated goods figure in the schedules of articles included under the Japanese Luxuries Bill, providing for an *ad valorem* duty of 100 per cent.

### Cruiser Programmes.

In several of my recent weekly letters I have referred to the disappointment experienced by Sheffield when the Government cruiser orders were placed. Two of the Members of Parliament for the city have taken steps to open a debate on the inadequacy of the cruiser programme. In certain quarters appeals are being made to the Government to stop the construction of the cruisers already ordered, and in this connection the Secretary to the Admiralty has stated that the cruiser contracts placed this year with private firms do not contain a cancellation clause. Nothing definite can yet be stated as to what share Sheffield is likely to get from the Australian cruiser programme, owing to the Commonwealth Parliament's slow progress with the necessary Bill of authorisation.

### Motor Omnibus Experiments.

Sheffield Corporation, which is going in extensively for motor omnibus developments, is now testing a new type of vehicle. It is of 45 horse-power, and carries all the passengers between the wheel base, with the object of avoiding bumping at the rear. The seating accommodation of fifty-two is evenly divided between the top and bottom decks. The roof is made of aluminium, which metal is also used extensively in the fittings.

### Crucible Steel Trade Fears.

The crucible steel industry, which is carried on almost exclusively in Sheffield, has grave fears as to the effect if the Hours of Industrial Employment Bill is passed into law. Its object is to ratify the Washington Convention with the proposal that hours of work should be limited by statute to eight hours per day and forty-eight hours per week. The crucible steel industry will have to be exempted from this Bill, or the law, if it is made such, must become a dead letter. Two heats are the minimum upon which the industry generally works, and upon which it is economical. These may be completed in less than eight hours, or they may take longer. An eight-hour day by law thus becomes impossible. It is inconceivable to think that the men will cease work at the end of eight hours and leave the steel to spoil, or that the employers will bring in a fresh set of men to work what may only be a short time necessary to complete the operation. Representations have already been made to the Government on this matter, and further steps are to be taken immediately.

### Cheap German Rails.

Hull Tramways Committee has decided to place an order for 1500 tons of rails with Bolckow, Vaughan and Co., Limited, of Middlesbrough. Their tender was £11 14s. 6d. per ton. Steel, Peech and Tozer, Limited, of Sheffield, quoted £15; the Anglo-Belgian Improvement Corporation, Brussels, £9 15s.; and an offer of German-made rails by the Equipment and Engineering Company, Limited, was the lowest, with a price of £9 9s. 6d. A letter from the Middlesbrough firm stated that for some considerable time British steel workers had been quite unable to meet foreign competition, owing principally to the fact that the foreign workmen worked much longer hours and got considerably less wages. If such competition was allowed to continue, many of the firms in this country would be compelled to close down before long. They hoped the Corporation would come to the conclusion, in the general interests of the community, to place the order in this country and endeavour to find employment for our own people. A Labour councillor proposed a resolution accepting the contract for the German-made rails, but this did not secure a seconder.

### French Steel Tariffs.

The new French steel tariff proposals—a matter of vital importance to the steel trade—have been considered by the Tariffs Committee of the Sheffield Chamber of Commerce. The Chamber, which considered a special report at its meeting on Tuesday, is alarmed at the French action, and points out that the serious increases will have the effect of almost prohibiting the export to France of certain classes of steel containing low percentages of nickel, chrome, tungsten, &c. The British Chamber of Commerce in Paris and the Commercial Relations Department of the Board of Trade—the co-operation and assistance of which were invited—have been informed of the serious situation which threatens the trade. The report states: "The British Chamber of Commerce in Paris informed the Chamber that nothing would be done in this matter by the French authorities for a long time to come, but that it would be advisable that the question should receive further consideration, so that, at the opportune moment, counter proposals might be submitted. They forwarded a copy of the official proposals for the alteration of the tariff. These documents have now received careful consideration by this Committee, and their fears are confirmed that the proposals, if adopted, would have the most damaging effect upon our trade with France in steels, particularly those in the Siemens-Martin and Bessemer steels, motor car steels, various alloy steels, and steel for tools. The proposals have two main features—(*a*) the increase of the duties by means of new classifications, and (*b*) the adoption of a gold basis for the payment of the duties." The proposed alterations in classification were outlined, and the report declared that the effect of certain suggested clauses would be practically to prohibit the exports to France of steels, such as mining steel, spring steel and the cheaper grades of tool steel. The report continued: "The most serious proposal, however, is that the duty should in future be payable in gold. This of itself would have the effect of more than trebling even the proposed increase of the duties, and is, of course, an absolutely unreasonable and prohibitive proposal."

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

### Cleveland Iron Trade.

THE depression which has hung over the Cleveland pig iron trade during the past few weeks still continues, and it is difficult to find an encouraging feature. The absence of business is not due so much to foreign competition—though continental firms continue to undersell producers here in many markets—as to a general cessation in the demand. Home inquiry is still very stagnant, but the main holiday obstacles to business are now being got out of the way, and next month should see some revival of demand. Many consumers bought well ahead just before last Easter, when values appeared to be favourable, and the subsequent continuous fall in prices has had the effect of keeping them determinedly out of the market. There is still a feeling that the bottom has not even yet been touched, and buying on any considerable scale cannot be looked for until a more stable position has been reached. Moreover, a good number of the foundries are not working full time, and in these circumstances there is no inducement to buy even at current figures. The export trade shows no signs whatever of opening out, inquiry being conspicuous by its absence. As a matter of fact, Cleveland iron cannot compete with French and Belgian iron, which is on offer at figures round about 82s. f.o.b. The exchange situation will have to alter very considerably if there is to be any real improvement. The steadily accumulating stocks of pig iron threaten to create an embarrassing statistical position. Makers are badly hampered by large quantities in their yards, and unless an early increase in demand occurs, several blast-furnaces will doubtlessly be put out of operation in the near future. Of the one hundred odd blast-furnaces on the North-East Coast, only forty-five are at present in operation, twelve producing Cleveland iron, sixteen hematite, and seventeen special kinds of iron. The market has been more or less idle this week, and prices, though showing a further downward tendency, are not apparently attractive. Business appears to be largely a matter of individual bargaining, and it is difficult to give really definite quotations. The standard No. 3 G.M.B. Cleveland quality is on offer at round about 86s. to 87s. per ton, but less would probably be taken against a reasonably firm offer. No. 1 is scarce, and stands at 92s., but No. 4 foundry and No. 4 forge are more or less nominal at about 85s. to 86s. and 84s. to 85s. per ton.

### Hematite Pig Iron.

The East Coast hematite pig iron trade is without any new feature of moment. Current shipments are mostly against old contracts, not yet fully implemented,

and new export business is extremely quiet. French hematite is stated to be obtainable in the neighbourhood of 84s. per ton. In the home trade demand is moderate, and there is keen competition for any business coming on to the market. East Coast mixed numbers are quoted at 94s. 6d. per ton, but this figure could be shaded for suitable business.

### Ironmaking Materials.

The foreign ore trade is absolutely lifeless. The sellers' quotation is about 22s. 6d. to 23s. per ton for best Rubio, c.i.f. Tees. Coke is weak, the price of average furnace kinds not being more than 26s. 6d. to 27s. per ton delivered at the works.

### Manufactured Iron and Steel.

Business in most branches of the manufactured iron and steel trade is characterised by inactivity, and there is keen competition for any orders that come on to the market. A few sales of shipbuilding requisites are reported, and one or two small rail contracts have been secured, whilst the demand for galvanised sheets is unabated. Producers are cutting their prices considerably in their efforts to secure overseas trade, but are meeting with little success.

### The Coal Trade.

Although still far from satisfactory, the position in the Northern coal trade shows a slight improvement on the past two or three weeks, and there is a more cheerful tone generally on the markets. Many collieries in the area are still working short time—in some instances two to three days a week—while others are dumping their output on the ground, which is a wasteful process, but necessary to keep pits working. A general feeling prevails, however, that the worst of the slump has been passed, and that a steady improvement will be noticed during the next few weeks. Shippers are looking to an early increase in the demand for gas coals, as many of the large consumers, London companies, &c., have continued to buy from hand to mouth, and forward contracts have been held off. In the Northumberland steam coal section there are more inquiries for future delivery than have been apparent during the last week or two, but at the same time buyers are somewhat chary of committing themselves. Prices are low, and the general feeling is that they cannot recede further under present conditions, and that any movement must be upwards. Consequently, fitters are unwilling to accept forward business at current prices, and operators are checked by similar considerations. A few inquiries are circulating for Durham gas coals, and supplies are plentiful, but sellers decline to make further concessions. With the autumn demand approaching, shipments are expected to increase. The coke market is quiet, but gas cokes are well booked and stemmed, and additional supplies are difficult to arrange for the first half of August, and sellers hold firmly to recent prices.

## SCOTLAND.

*(From our own Correspondent.)*

### An Idle Week.

Business has been almost at a standstill during the past ten days, owing to the annual fair holidays. At the time of writing, some of the works are again in operation, but a considerable number of establishments will not reopen until Monday first. Under the circumstances, very little interest has been taken in markets, and the attendance on 'Change has been meagre.

### Labour Affairs.

The Board of Conciliation for the regulation of wages in the Scottish pig iron trade has had under consideration the prices obtained during April, May and June. The average net selling price has been certified as being £4 9s. 11d. per ton, and this finding means a reduction of 1 per cent. on basis rates of wages. Wages in the manufactured iron trade are unaltered as a result of the ascertainment of the average price obtained during May and June, which has been certified as being £12 11s. per ton net.

### Steel and Iron.

The demand for steel material has not shown any increase, and prospects for restarting after the holidays are distinctly dull. A few establishments here and there have a moderate amount of work on hand, but the majority are in a comparatively poor position. The specifications for plates and sections have been far below expectations, and there has been no indication of an early improvement. So far as the steel trade is concerned, the only satisfactory feature is the continued export demand for thin sheets. Orders for these have been booked over the last three months of the year. Galvanised descriptions are particularly busy, and are especially firm in price. Bar iron makers are poorly placed for new orders, and although they have a moderate amount of work on hand, the outlook is far from bright. Re-rolled steel is also in very light demand, and remains round about £9 10s. to £9 15s. per ton, home or export. The decrease in the export demand, generally, has been severely felt, and while it is believed that a revival may take place before long, there has been little sign of improvement so far. The fact that it is contemplated sending shipping orders abroad which would otherwise be carried out at home is not very reassuring, when it is remembered that the degree of prosperity on the Clyde practically means the degree of activity in the steel and iron trades of this area, and more especially is that the case when the export markets are more or less dormant, as they have been for some time back.

### Coal.

Generally speaking, there has been an almost complete lull in the coal trade throughout the holiday time. The Ayrshire district has provided an exception. Several collieries in that area have been kept in operation, a good all-round demand having been experienced for all descriptions, except smalls. On the whole, prospects are still unsatisfactory. Export demands have been very restricted, and though there has been some activity on Italian account, the difference between seller's and buyer's ideas of prices has so far proved a stumbling block. Bunkering orders have been fair. Shipments from the Clyde and the Firth of Forth were moderate, but with the exception of a small consignment from Alloa the Fifeshire ports have been entirely inactive. Aggregate clearances amounted to 130,864 tons, against 253,765 tons in the preceding week, and 267,359 tons in the same week last year. The home trade has been dull for some time, and practically nothing was bought over the holidays, and many of the collieries have considerable quantities of fuel at the sidings.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

### Coal Trade Position.

There has been no development in the coal export trade during the past week, and no material change or new feature is expected in view of the imminence of the holidays. It has now been definitely decided that there shall be three days holiday in the coalfield next week, and as many of the miners will in all probability extend their leave to the end of the week, outputs will be considerably curtailed, and coalowners will be enabled to get shipped a substantial part of their standing stocks. The conditions in the trade have certainly showed a steadier tone during the past week as a result of the tonnage position having improved, but as a good many steamers which were expected this week are not likely to arrive now before the holidays, it is fair to assume that the docks will be fairly well provided with steamers when work is resumed after the holidays. Being a short month the colliery owners are looking for better conditions during August than has been the case recently, and it is interesting to note that already there are some of the best Admiralty large coals which are very fully stemmed up for nearly the whole of next month. This may be exceptional, but the fact that these particular collieries are so well placed may re-act favourably on other concerns which as yet are not so well off. Business on the whole is comparatively quiet, but the conditions are not quite so depressing as they have been. No new orders of any magnitude have been closed of late, though it is understood that the contract for the supply of over 50,000 tons of steam coals or fuel for the Algerian State Railways is likely to be secured by Pyman, Watson and Co.

### Coalfield Items.

The feared strike on the part of about 40,000 miners in the Rhondda No. 1 district in pursuance of their campaign against the non-unionist did not mature at the end of last week as was expected. The strike has, in fact, been postponed for a fortnight, the reason being that the district committee had received favourable reports from the different lodges as to the number of non-unionists who had fallen into line. There is just a chance that at the end of the fortnight the notices will be withdrawn, as the leaders may not consider it worth their while to have a strike if their campaign meets with distinct success. Satisfactory news also comes from the Blaenavon area, where, as the result of lengthy negotiations between the Blaenavon Company and the 1400 miners employed by it at its Big Pit, work is to be resumed. The company recently closed down the pit, but since then the men have accepted certain terms submitted by the employers which make it possible for them to restart work.

### New Coal Discovery.

The announcement is made that a new find of coal has been made at Glangwyddfan, near Llandebie, the vein having a thickness of 3ft. 10in. A new company is to be formed immediately. The site of the new discovery is within easy distance of the London, Midland, and Scottish and Great Western Railways.

### Tin-plate Trade.

The annual meeting of the Joint Industrial Council which controls the tin-plate industry was held last week and passed off very satisfactorily, though there are a number of items which have to be dealt with later. Much to the regret of all associated with the trade, Mr. F. W. Gibbins, who has been for many years president of the Employers' Association, resigned from this office. Mr. F. W. Gilbertson, the vice-president, took the chair. One statement of the chairman's was interesting, and that was that from what he had seen during a recent visit to Roumania tin-plates sheets were being produced there of a quality which would compare favourably with the Welsh manufactures and at a considerably cheaper cost of production. The probable result was that the Roumanians would be able to supply their own needs, which would be a very serious blow to a hitherto extensive trade between South Wales and Roumania. With regard to the deliberations of the Council, the claims of the various workmen, which originally numbered 71 were reduced to 21. The question of amending the constitution was referred to a meeting of the Joint Standing Committee convened for August 12th, though the employers made no secret of their indisposition to tamper with the existing machinery which has worked so well in the past. The employers intimated their inability to concede the application that all datal workmen over twenty-one years of age should be paid a gross weekly wage of 55s., but the matter is likely to be brought up again at the adjourned meeting. The proposal that employers should agree to the principle of establishing a superannuation scheme for aged workmen, and that a fund should be established by a levy on every box of tin-plates sold, was described by the employers as absolutely beyond consideration in the present state of the industry, while they also rejected the application that the workmen should be paid for the loss of wages in respect of the annual week's holiday, which it was said would cost over £80,000. A number of claims were not gone into, and were adjourned for consideration until August 11th.

### Ship-repairers' Wages.

Since intimating that an agreement had been come to between the dry dock employers and a number of their workmen on the question of an advance of wages, viz., 2s. 6d. on time rates to operate at once, and a further 2s. 6d. from October 1st next, it has been officially stated that the workers concerned embrace the boilermakers and rivet warmers, wood workers, joiners, plumbers, electricians, transport workers and shipwrights. So far, however, the members of the Amalgamated Engineering Union have not come to terms, and unfortunately they have reimposed the embargo on overtime and chargemen, which was raised some time ago to enable a conference to take place between them and the employers. The Bristol Channel members of the Amalgamated Engineering Union have rejected the offer of 5s. in two instalments.

### Trimmers' and Tippers' Holidays.

There will be no work on coal shipments at South Wales ports on Monday and Tuesday next, and it has been arranged that the trimmers and tippers shall work two short shifts on the following day—Wednesday—the first to be from 8 a.m. to 12 noon and the second from 12 noon to 4 p.m. Normal working will recommence on Thursday.

### Current Business.

There has not been much fresh business in steam coals during the past week, and the efforts of coal exporters and colliery owners have been concentrated principally on getting away tonnage before the holidays. There has certainly been more activity at the docks, at some of which there have actually been a number of steamers waiting their turn to load. The market has shown a steadier appearance, more especially for superior Admiralty large and superior smalls, which have become scarcer. Lower grades of coal have, however, continued to be somewhat irregular. Patent fuel and coke have displayed no new feature, but anthracite coals have maintained a fairly good tone on the whole, and collieries are pretty busy.

## LAUNCHES AND TRIAL TRIPS.

Gallium, steel screw collier; built by the Blyth Shipbuilding and Dry Dock Company, to the order of A. Lemoine et Fils, Rouen; dimensions, 271ft. by 37ft. 3in. Engines, triple-expansion, 21in., 34in., 56in.; constructed by North-Eastern Marine Engineering Company, Limited; trial trip, July 15th.

Lubrafol, twin-screw motor-driven oil tanker; built by Sir W. G. Armstrong, Whitworth and Co., Limited, to the order of the Société Anonyme d'Armament, d'Industrie et de Commerce of Antwerp; dimensions, length overall about 455ft., length between perpendiculars 440ft., breadth moulded 57ft. 2in., depth moulded to upper deck 33ft. 11in.; to carry 10,000 tons on a mean draught of 26ft. 4½in. Engines, two sets Armstrong-Sulzer Diesel inverted four-cylinder direct-acting reversible two-cycle type, designed to develop 2700 horse-power continuously at sea at about 110 revolutions per minute; constructed by the builders; launch, July 16th.

Aracataca, single-screw steamer; built by Cammell Laird and Co., Limited, to the order of Elders and Fyffes, Limited; dimensions, 400ft., 51ft. and 32ft. 11in. from upper deck; to carry fruit cargoes. Engines, triple-expansion, 27in., 46½in. and 78in. by 54in. stroke, pressure 210 lb.; constructed by the builders; launch, July 17th.

City of Bedford, steamer; built by William Gray and Co., Limited, to the order of Ellerman Lines, Limited; dimensions, 446ft. 6in. by 55ft. by 33ft. 9in.; to carry gross tonnage 6400. Engines, balanced quadruple inverted direct-acting, surface condensing, 24in., 35in., 51in., 74in., pressure 250 lb. per square inch; constructed at the Central Marine Engine Works, of Wm. Gray and Co.; launch, July 17th.

Elfstone, self-trimming collier; built by Swan, Hunter and Wigham Richardson, Limited, to the order of the Crete Shipping Company, Limited, of London; dimensions, 235ft., 36ft. by 17ft. 6in. moulded; to carry 2100 tons deadweight. Engines, triple-expansion; constructed by the builders; launch, July 17th.

Takliwa, twin-screw steamer; built by Barclay, Curle and Co., Limited, to the order of British India Steam Navigation Company, Limited; dimensions, 465ft. by 60ft. by 41ft.; to carry passengers and cargo. Engines, triple-expansion; constructed by the builders; trial trip, July 17th.

James Dunford, steamer; built by Swan, Hunter and Wigham Richardson, Limited, to the order of Dunford Steamship Company, Limited; dimensions, 235ft. by 36ft. by 16ft.; to carry 1500 tons. Engines, triple-expansion, pressure 180 lb. per square inch; constructed by North-Eastern Marine Engineering Company, Limited; launch, July 18th.

Self-propelled Hopper Barge; built by Cammell Laird and Co., Limited, to the order of The Mersey Docks and Harbour Board; dimensions, 207ft. by 35ft. 6in. by 16ft. 3in. Engines, triple-expansion, driving a single screw; constructed by the the builders; launch, July 19th.

Domira, cargo steamer; built by Wm. Gray and Co., Limited, to the order of Maclay and McIntyre, Limited; dimensions, 364ft. by 50ft. by 27ft. Engines, triple-expansion, 25in., 40½in., 67in. by 45in. stroke, pressure 180 lb.; constructed by the builders; trial trip, July 28th.

The Institution of Electrical Engineers.—A.M.I.E.E. Examination.—The next examination for election to associate membership of the Institution of Electrical Engineers will be held on October 30th, 31st, and November 1st. Candidates must be either students or graduates of the Institution or have lodged with the secretary a duly completed form "E" for election as associate member. Entry forms for the examination, which must be completed and returned by September 1st, and particulars regarding election to membership of the Institution may be had on application to the Secretary, the Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. Coast— | |
| Native | 17/6 to 24/- |
| (1) Spanish | 23/- |
| (1) N. African | 23/- |
| N.E. Coast— | |
| Native | — |
| Foreign (c.i.f.) | 22/6 |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) Scotland— | | |
| Hematite | 4 16 3 | — |
| No. 1 Foundry | 4 18 9 | — |
| No. 3 Foundry | 4 13 9 | — |
| N.E. Coast— | | |
| Hematite Mixed Nos. | 4 14 6 | 4 14 6 |
| No. 1 | 4 15 6 | 4 15 6 |
| Cleveland— | | |
| No. 1 | 4 12 0 | 4 12 0 |
| Silicious Iron | 4 12 0 | 4 12 0 |
| No. 3 G.M.B. | 4 6 9 | 4 6 0 |
| No. 4 Foundry | 4 5 0 | 4 5 0 |
| No. 4 Forge | 4 4 0 | 4 4 0 |
| Mottled | — | — |
| White | — | — |
| Midlands— | | |
| (3) Staffs.— | | |
| All-mine (Cold Blast) | 9 2 6 | — |
| North Staffs. Forge | 4 5 0 | — |
| „ „ Foundry | 4 10 0 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 4 2 6 | |
| „ Forge | 4 0 0 | — |
| (3) Derbyshire— | | |
| No. 3 Foundry | 4 7 6 | |
| Forge | 4 4 0 to 4 5 0 | |
| (3) Lincolnshire— | | |
| No. 3 Foundry | 4 12 0 | — |
| No. 4 Forge | 4 13 0 | — |
| Basic | 4 5 0 to 4 10 0 | |
| (4) N.W. Coast— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 5 10 0 (a) / 5 15 0 (b) | — |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| Scotland— | | |
| Crown Bars | 12 10 0 | — |
| Best „ | — | — |
| N.E Coast— | | |
| Common Bars | 12 10 0 | — |
| Lancs — | | |
| Crown Bars | 13 0 0 | — |
| Second Quality Bars | 12 0 0 | — |
| Hoops | 15 0 0 | 14 15 0 |
| S. Yorks.— | | |
| Crown Bars | 13 10 0 | — |
| Best „ | 14 0 0 | — |
| Hoops | 15 0 0 | — |
| Midlands— | | |
| Crown Bars | 13 0 0 | — |
| Marked Bars (Staffs.) | 15 0 0 | — |
| Nut and Bolt Bars | 12 0 0 | — |
| Gas Tube Strip | 13 5 0 to 13 7 6 | — |

## STEEL.

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) Scotland— | | |
| Boiler Plates | 13 10 0 | — |
| Ship Plates, ¼in. and up | 10 5 0 | — |
| Sections | 10 0 0 | — |
| Steel Sheets, 3/16in. to ¼in. | 12 10 0 | — |
| Sheets (Gal. Cor. 24 B.G.) | — | 18 10 0 |

## STEEL (*continued*).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. Coast— | | |
| Ship Plates | 10 5 0 | — |
| Angles | 10 0 0 | — |
| Boiler Plates | 13 10 0 | — |
| Joists | 10 0 0 | — |
| Heavy Rails | 9 0 0 | — |
| Fish-plates | 13 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5 |
| Hard Billets | 9 10 0 | — |
| Soft Billets | 8 10 0 | — |
| N.W. Coast— | | |
| Barrow— | | |
| Heavy Rails | 9 5 0† | — |
| Light „ | 9 10 0 to 10 0 0† | |
| Billets | 8 10 0 to 12 0 0† | |
| Manchester— | | |
| Bars (Round) | 10 5 0 to 10 15 0 | |
| „ (others) | 10 0 0 to 10 2 6 | |
| Hoops (Best) | 15 5 0 | 15 0 0 |
| „ (Soft Steel) | 13 15 0 | 13 10 0 |
| Plates | 10 0 0 to 10 5 0 | — |
| „ (Lancs. Boiler) | 13 10 0 | — |
| Sheffield— | | |
| Siemens Acid Billets | 12 10 0 | — |
| Bessemer Billets | 13 0 0 | — |
| Hard Basic | 10 0 0 to 10 5 0 | |
| Intermediate Basic | 9 10 0 to 10 0 0 | |
| Soft Basic | 8 5 0 to 8 10 0 | |
| Hoops | 12 10 0 to 13 0 0 | |
| Soft Wire Rods | 11 0 0 to 11 10 0 | |
| Midlands— | | |
| Small Rolled Bars | 10 0 0 to 10 10 0 | |
| Billets and Sheet-bars | 7 12 6 to 7 15 0 | |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | |
| Galv. Sheets, f.o.b. L'pool | 18 5 0 | — |
| Angles | 9 15 0 to 10 0 0 | |
| Joists | 9 15 0 to 10 0 0 | |
| Tees | 10 15 0 to 11 0 0 | |
| Bridge and Tank Plates | 10 10 0 | — |
| Boiler Plates | 14 0 0 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| Swansea— | |
| Tin-plates, I.C., 20 by 14 | 22/7½ to 22/10½ |
| Block Tin (cash) | 242 5 0 |
| „ (three months) | 242 10 0 |
| Copper (cash) | 63 5 0 |
| „ (three months) | 64 5 0 |
| Spanish Lead (cash) | 33 15 0 |
| „ (three months) | 32 0 0 |
| Spelter (cash) | 32 13 9 |
| „ (three months) | 32 10 0 |
| Manchester— | |
| Copper, Best Selected Ingots | 69 0 0 |
| „ Electrolytic | 70 0 0 |
| „ Strong Sheets | 94 0 0 |
| „ Tubes (Basis price) | 0 1 1½ |
| Brass Tubes (Basis price) | 0 1 0 |
| „ Condenser | 0 1 2½ |
| Lead, English | 35 14 0 |
| „ Foreign | 34 5 0 |

## FERRO ALLOYS.

(*All prices now nominal.*)

| | Per Ton. | Per Unit. |
|---|---|---|
| Tungsten Metal Powder | 1/8½ per lb. | |
| Ferro Tungsten | 1/4½d. per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £24 0 0 | 10/6 |
| „ 6 p.c. to 8 p.c. „ | £23 10 0 | 8/- |
| „ 8 p.c. to 10 p.c. „ | £23 0 0 | 8/- |
| „ Specially Refined | | |
| „ Max. 2 p.c. carbon | £42 10 0 | 16/- |
| „ „ 1 p.c. „ | £51 0 0 | 17/6 |
| „ „ 0.75 p.c. carbon | £68 0 0 | 20/- |
| „ „ carbon free | 1/5 per lb. | |
| Metallic Chromium | 4/2 per lb. | |
| Ferro Manganese (per ton) | £17 for home, £17 for export | |
| „ Silicon, 45 p.c. to 50 p.c. | £12 0 0 scale 5/- per unit | |
| „ „ 75 p.c. | £18 10 0 scale 6/- per unit | |
| „ Vanadium | 19/3 per lb. | |
| „ Molybdenum | 8/3 per lb. | |
| „ Titanium (carbon free) | 1/3 per lb. | |
| Nickel (per ton) | £135 | |
| Cobalt | 10/6 per lb. | |
| Aluminium (per ton) | £120 to £130 | |

## FUELS.

### SCOTLAND.

| | Export. |
|---|---|
| Lanarkshire— | |
| (f.o.b. Glasgow)—Steam | 17/3 |
| „ „ Ell | 18/6 |
| „ „ Splint | 20/- to 23/- |
| „ „ Trebles | 19/- |
| „ „ Doubles | 18/- |
| „ „ Singles | 17/- |
| Ayrshire— | |
| (f.o.b. Ports)—Steam | 17/3 |
| „ „ Splint | 20/- |
| „ „ Trebles | 19/- |
| Fifeshire— | |
| (f.o.b. Methil or Burntisland)—Steam | 15/- to 19/9 |
| Screened Navigation | 25/6 to 26/- |
| Trebles | 21/- to 22/6 |
| Doubles | 18/9 |
| Singles | 17/3 |
| Lothians— | |
| (f.o.b. Leith)—Best Steam | 17/6 |
| Secondary Steam | 16/6 |
| Trebles | 21/- to 22/6 |
| Doubles | 19/- |
| Singles | 17/- |

### ENGLAND.

| | Export. |
|---|---|
| (3) N.W. Coast— | |
| Steams | 29/- |
| Household | 45/- to 58/4 |
| Coke | 31/- |
| Northumberland— | |
| Best Steams | 20/6 to 21/- |
| Second Steams | 18/6 to 19/- |
| Steam Smalls | 10/6 |
| Unscreened | 16/- to 17/- |
| Household | 27/6 |
| Durham— | |
| Best Gas | 21/6 to 23/- |
| Second | 18/6 to 20/- |
| Household | 27/6 |
| Foundry Coke | 25/- to 26/- |

| Sheffield— | Inland. | Export. |
|---|---|---|
| Best Hand-picked Branch | 34/- to 35/- | — |
| Barnsley Best Silkstone | 28/- to 29/- | — |
| Derbyshire Best Brights | 28/- to 30/- | — |
| „ „ House | 25/- to 27/- | — |
| „ „ Large Nuts | 24/- to 25/- | — |
| „ „ Small „ | 18/6 to 20/6 | — |
| Yorkshire Hards | 23/- to 24/- | — |
| Derbyshire „ | 21/6 to 23/6 | — |
| Rough Slacks | 12/6 to 15/6 | — |
| Nutty „ | 12/- to 14/- | — |
| Smalls | 8/- to 10/- | — |
| Blast-furnace Coke (Inland)* | — | — |
| „ „ (Export) | f.o.b. | 25/- to 26/- |

### (9) SOUTH WALES.

| Cardiff— | |
|---|---|
| Steam Coals : | |
| Best Smokeless Large | 28/- to 28/6 |
| Second „ „ | 27/- to 28/- |
| Best Dry Large | 26/6 to 27/- |
| Ordinary Dry Large | 25/- to 26/- |
| Best Black Vein Large | 26/6 to 27/- |
| Western Valley „ | 26/- to 26/6 |
| Best Eastern Valley Large | 25/- to 26/- |
| Ordinary „ „ | 24/- to 25/- |
| Best Steam Smalls | 16/6 to 17/- |
| Ordinary „ | 15/ to 16/- |
| Washed Nuts | 25/- to 27/- |
| No. 3 Rhondda Large | 27/- to 28/- |
| „ „ Smalls | 22/6 to 23/- |
| No. 2 „ Large | 24/- to 25/- |
| „ „ Through | 20/- to 22/6 |
| „ „ Smalls | 15/- to 16/- |
| Foundry Coke (export) | 47/6 to 55/- |
| Furnace Coke (export) | 30/ to 35/- |
| Patent Fuel | 28/- to 29/6 |
| Pitwood (ex ship) | 28/- to 29/- |
| Swansea— | |
| Anthracite Coals : | |
| Best Big Vein Large | 50/- to 52/6 |
| Seconds | 42/6 to 45/- |
| Red Vein | 27/6 to 30/- |
| Machine-made Cobbles | 57/6 to 60/- |
| Nuts | 52/6 to 60/- |
| Beans | 39/- to 41/- |
| Peas | 23/- to 25/- |
| Breaker Duff | 9/9 to 10/3 |
| Rubbly Culm | 14/6 to 15/- |
| Steam Coals : | |
| Large | 24/- to 25/- |
| Seconds | 22/- to 23/- |
| Smalls | 15/- to 19/- |
| Cargo Through | 18/- to 20/- |

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow.

(8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o b. for export. (9) Per ton f.o.b.

* For blast furnaces only, 21/- to 25/-; open market, 27/6 to 28/6. † Latest quotations available. (a) Delivered Sheffield or Glasgow. (b) Delivered Birmingham.

# French Engineering Notes.

*(From our Correspondent in Paris.)*

### Agricultural Engineering.

The announcement that the Government intends to offer further relief to agriculturists by restoring the import duties on wheat and practically suppressing the duties on agricultural implements and machinery, so as to bring down farming costs, has provoked a feeling of indignation amongst French agricultural engineers, who declare that the future of the industry will be seriously compromised if the market is left open to the free competition of foreign machines. This vigorous protest against the free importation of farm implements is characteristic of the methods employed by the French to hold on to any advantage they may possess, however small, for they are perfectly well aware that with the exchange rate at anything like the present level it is impossible for foreign firms to do business in this country, except in harvesting machinery, which the French are unable to turn out in sufficient quantities themselves. The cost of binders, for example, is so high that farmers will not buy them unless they are absolutely compelled to do so. A reduction or suppression of the comparatively low import duties will not affect the selling price to any appreciable extent. Still, it may have some effect upon the prices on the home market, and that is apparently what is causing most trouble. Business in agricultural machinery can only revive when the exchange rate improves sufficiently and when farmers are able to find the labour to put their land under cultivation.

### Coke Supplies.

The Société des Cokes de Hauts-Fourneaux, known as the "Scof," was created at the time the French entered the Ruhr to centralise the supplies of coke and distribute them amongst blast-furnace proprietors. At the beginning of last March it was replaced by another body called the Office de Répartition des Cokes Allemands—or "Orca." The "Scof" has now issued a report upon its operations during the thirteen months of its existence, from which it appears that almost insuperable difficulties had to be overcome in order to provide the blast-furnaces with sufficient quantities of coke. Despite the "passive resistance" of the Germans in the Ruhr, the seizure of stocks enabled the "Scof" to distribute 1,847,500 tons of coke. In addition to this the French collieries supplied 487,600 tons of coke, and the "Scof" hired a number of coke ovens, the monthly production of which increased during the year from 15,000 tons to 120,000 tons, making a total of 1,116,000 tons. The "Scof" also purchased 382,000 tons of coke from abroad, including 200,000 tons from England. From these and other sources the total quantity of coke distributed during the thirteen months was 4,724,500 tons, while in the previous twelvemonth the consumption was 5,606,000 tons. It is certain that some large stocks were left over from this latter total, so that during 1923 the blast-furnaces were kept fairly well supplied, and the production of iron and steel steadily increased. The high prices that had to be paid for English and other imported coke and for the English and Dutch coal used for the production of coke in French ovens, added to the exceptionally high cost of transport, resulted in the price of coke increasing during the year from 95f. to 220f. a ton. Nevertheless, the "Scof" was unable to make any profit on its transactions.

### The Merchant Marine.

The law which was passed soon after the Armistice imposing an eight hours' working day was of so general an application that it extended to the merchant marine, and it has since been a constant source of trouble and friction between the seamen and shipowners. At first the seamen claimed a presence of eight hours on board, which was soon found to be absolutely impracticable, and then after many strikes it was decided that the limitation should apply to eight hours' effective work. As, however, the law only permits of ships carrying a very small percentage of foreign hands the shipowners found that the supply of French seamen to make up for the deficiency caused by the operation of the eight hours' day was quite inadequate. Each ship had to carry a much larger number of hands, with the result that the charges became quite intolerable. The law therefore became practically a dead letter, but the seamen have not relaxed their efforts to ensure its being enforced, and after a considerable amount of controversy a final conference has been held with a view of effecting a compromise. The shipowners argue that it is quite impossible to entertain an eight hours' day that will place them in a state of inferiority with regard to the foreign marines. They will only accept the limitation on condition of its being adopted by international agreement. As the matter is at a deadlock it is possible that a decision will be left to the Government.

### Foreign Trade.

Notwithstanding a falling off in the imports and exports during the last two months of the half-year, the total shows a notable expansion in values all round, owing mainly to the currency depreciation, which has enormously increased the returns expressed in francs. The exports exceeded the imports, and of the former total manufactured goods were responsible for nearly two-thirds, the value of such goods being 5370 million francs in excess of that during the first six months of 1923. Judged by the weights the comparison is still satisfactory, for the 28,141,728 tons of imports included 24,642,007 tons of coal and raw material and only 755,332 tons of manufactured goods, while in the total of 13,717,481 tons of exports manufactured goods were responsible for 1,703,929 tons, an increase of 374,228 tons as compared with the first half of last year. The exports of raw material, amounting to 11,279,765 tons, showed an augmentation of 1,862,743 tons. On the whole, therefore, the "balance of trade" is in favour of this country.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

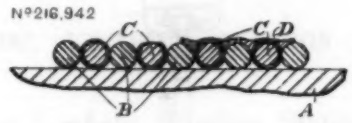
*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

### BATTERIES AND ACCUMULATORS.

216,942. December 4th, 1922.—Improvements in Selenium Cells, William Prior, of 215, Upper Grosvenor-road, Tunbridge Wells, and Clara Ellen Riley, of Brant Knoll, Heskoth-road, Ashton-on-Mersey, near Manchester.

The selenium cell described in this specification is composed of a bare conductor B and an insulated conductor C, wound bi-spirally on slate or some other insulating conductor A. After

N°216,942



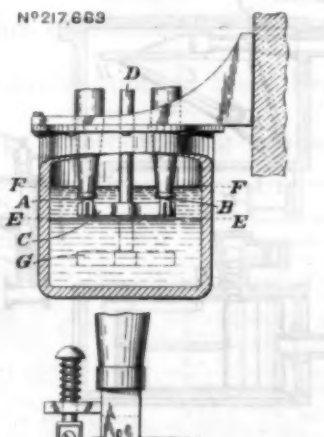

removing the insulation from the upper surface of the insulated conductors, selenium D is applied in the usual manner, and the cell is heated at the proper temperature. When this process is completed, a thin even layer D of selenium is formed over the surface of the wires. Several alternative schemes are described.—*June 4th*, 1924.

### SWITCHGEAR.

217,663. March 23rd, 1923.—Improvements in Electric Switches and Circuit Breakers, Edmund Basil Wedmore and the British Electrical and Allied Industries Research Association, of 10, Tothill-street, Westminster, S.W. 1.

The contacts A and B are normally bridged by an electrically conducting blade or bridge piece C, which is attached to a rod D sliding in the cover of the switch. The switch case is filled with water up to the level indicated by the broken line E just below the lowest point of the contacts A and B and the bridge piece C

N°217,663



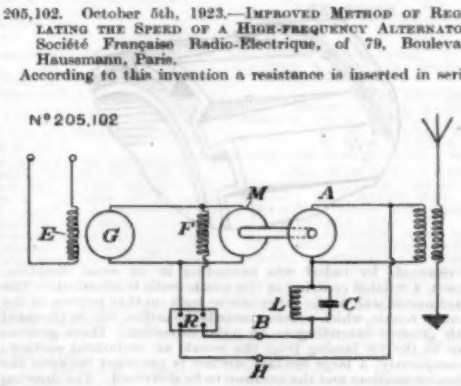

when in its normal position. A layer of oil is floated upon the top of the water of sufficient depth to cover the uninsulated portion of the switch electrodes. The level of this oil is indicated by the broken line F. In operation the rod D carrying the bridge piece C is moved down so that the bridge piece occupies the position shown at G. Thus the arc, although commencing in the oil, is drawn out into the water and more rapidly quenched thereby than would be the case if oil only were used. In order to secure the greatest benefit of this invention, the switch contacts are so arranged that the whole of the arc may take place beneath the water, as shown in the lower drawing.—*June 23rd*, 1924.

### TELEGRAPHS AND TELEPHONES.

205,102. October 5th, 1923.—Improved Method of Regulating the Speed of a High-frequency Alternator, Société Française Radio-Electrique, of 79, Boulevard Haussmann, Paris.

According to this invention a resistance is inserted in series

N°205,102



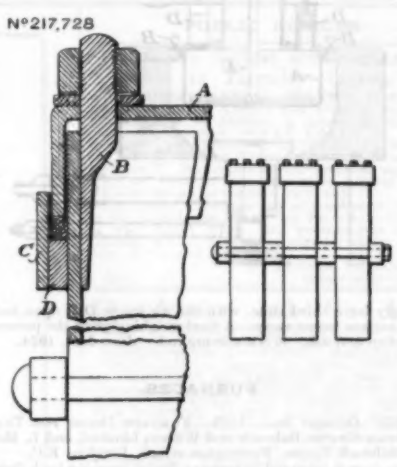

with the excitation circuit of the motor or of the generator which feeds the motor that drives the alternator. The value of this resistance is varied by the passage of the high-frequency current. In the diagram G is the generator and E its exciting winding. M is the continuous-current motor and F its exciting winding. A is the high-frequency alternator, R the resistance, the value of which is varied by the passage of the high-frequency current through it. The resonance circuit is shown at L C, and it is adjusted to lessen the high-frequency current passing through the resistance R when the frequency of the alternator A attains a predetermined value. H and B are terminals. It is stated that a boron filament may be employed in series with the excitation circuit, as its resistance is modified according to the voltage of the high-frequency current.—*June 26th*, 1924.

### TRANSFORMERS AND CONVERTERS.

217,728. May 14th, 1923.—Improvements in and relating to Tanks for Oil-cooled Transformers and the like and other Closed Receptacles, *The British Thomson-Houston Company, of Crown House, Aldwych, W.C.* 2.

The cover A, which in this particular case belongs to an oil

N°217,728




switch, is secured in position by a bolt B which is welded to the tank. The parts C and D are also welded in position and a gasket forms a gas tight and oil-tight joint. A number of tanks may be grouped and clamped together as shown in the right-hand illustration.—*June 26th*, 1924.

### TRANSMISSION OF POWER.

217,696. April 17th, 1923.—Improvements relating to Joints in Electric Cables, Siemens Brothers and Co., Limited, Caxton House, Tothill-street, London, S.W. 1; and Arthur Ernest Foster, of "Fairlawn," Old Charlton, S.E. 7.

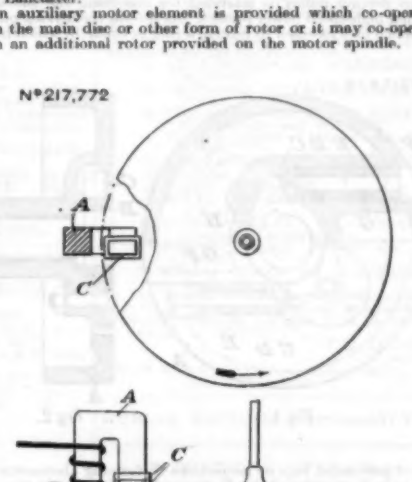
This invention relates to joints in electric cables which are provided with a lead sheathing, and mainly to joints that are under water. At the places where the connecting sleeve is attached to the lead sheathing of the cable a covering of waterproof flexible material is applied. This covering may be continued over the whole length of the lead sheath and a little beyond the wiped places, or the two wiped places may be separately covered if the sleeve is known to be sound. Gutta percha, balata, rubber, &c., may be used for the covering material. Outside the waterproofing layer a protective covering may be provided. This covering may consist of hemp or the joint may be taped over. The exact method of making the joint in accordance with the invention is described.—*June 26th*, 1924.

### MEASURING AND TESTING INSTRUMENTS.

217,772. June 29th, 1923.—Improvements in and relating to Alternating-current Electricity Meters, Sebastian Ziani de Ferranti and Ferranti Limited, of Hollingwood, Lancaster.

An auxiliary motor element is provided which co-operates with the main disc or other form of rotor or it may co-operate with an additional rotor provided on the motor spindle. The

N°217,772

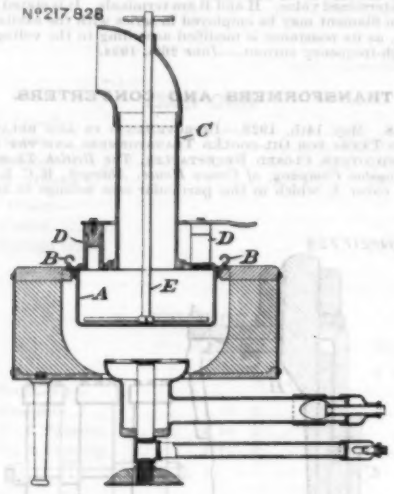



auxiliary motor element comprises a C-shaped electro-magnet A, which is energised by a coil B connected in series with the ordinary circuit of the motor. The pole pieces are bifurcated and are provided with copper rings C, thus producing a driving torque which increases with increase in load current.—*June 26th*, 1924.

217,828. October 26th, 1923.—Coal Analysis Apparatus, R. Alexander, 26, Hyde-vale, Greenwich.

In using this apparatus a sample of the coal, weighing about a pound, is put in the crucible A and is heated gently to drive off the moisture. The gas heater is arranged to provide both large and small flames. The crucible is then suspended by the hooks

B B on a weigh beam and the amount of moisture ascertained. The crucible is returned to the furnace and heated strongly. The volatile constituents of the coal are driven off through the vent C and another weighing made. The sample is heated

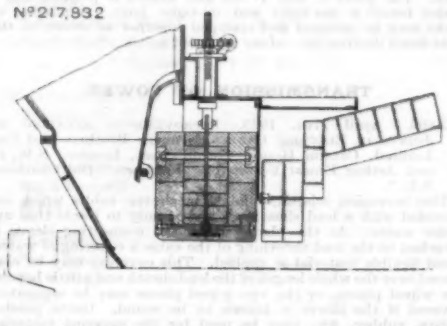



strongly for a third time, with the air inlets D D open and the fixed carbon burnt away. A final weighing gives the percentage of carbon and ash. E is a stirring rod.—*June 26th*, 1924.

## FURNACES.

217,832. October 30th, 1923.—Furnace Doors for Travelling Grate, Babcock and Wilcox, Limited, and L. Morton, Babcock House, Farringdon-street, London, E.C.

This door is intended to prevent flames creeping back from the furnace to the hopper when such fuel as hot coke from a distilla-




tion plant is being burned. For this purpose the thickness of the door is made several times greater than the normal distance between the bottom edge of the door and the grate. The door is built up of refractory elements as shown in the drawing.—*June 26th*, 1924.

## MACHINE TOOLS AND SHOP APPLIANCES.

217,420. June 11th, 1923.—Power Presses, Taylor and Challen, Limited, and W. B. Challen, Constitution-hill, Birmingham.

This driving pulley is intended for absorbing the shock in working high-speed power presses. As shown, the driving pulley A has one face recessed to receive a ring or collar B, which has a

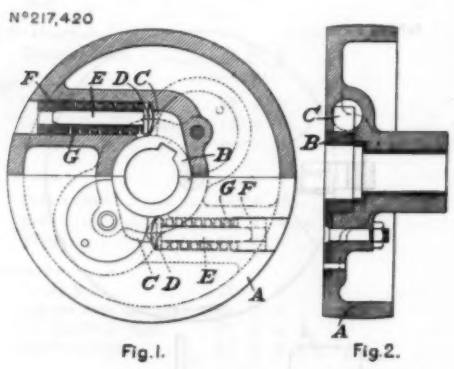
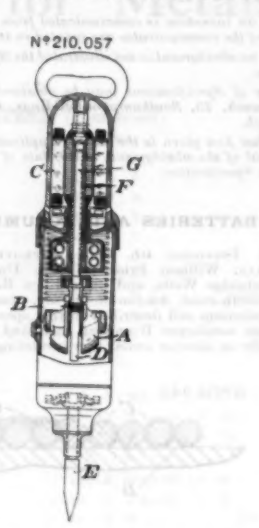



Fig. 1. Fig. 2.

pair of peripheral lugs or projections C, forming abutments for the heads D of sliding bolts E disposed in apertures in the web of the wheel. Adjustable plugs F serve as the outer abutments of spiral springs G, the opposite or inner ends of which abut against shoulders formed by the heads of the sliding bolts.—*June 19th*, 1924.

210,057. December 22nd, 1923.—A Percussive Hand Tool, Det Tekniske Forsøgsaktieselskab, of 30, Kirkevej, Ordrup, Charlottenlund, Denmark.

This invention relates to percussive hand tools of the kind in which a striking piece or tup is movable in a casing and reciprocated by the action of one or more rotating flyweights mounted on the tup, the flyweights being driven by gearing from an electric motor. It is usual for the tup to make one blow for each revolution of the flyweight, but it is found, according to the inventors, that at certain speeds above a certain critical value the number of impacts of the tup becomes a fraction of the number of revolutions of the flyweight, that is to say, the tup makes one blow for each two, three, four or more revolutions of the flyweight, the number of blows per unit of time decreasing as the speed of the flyweights is increased. Not only does the number of impacts of the tup decrease; it has been found that the force of the blow increases with the decrease in the number of blows of the tup, so that by increasing the speed at which the flyweights rotate the strength of the blow can be materially increased without increasing the weight of the tool. It has also been found that in the interval between the actual working or

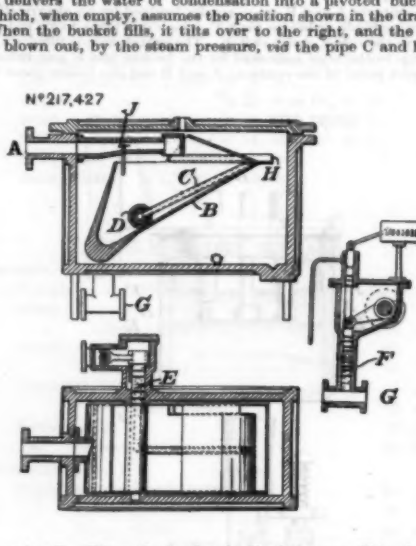



striking strokes of the tup the latter carries out idle strokes which do not reach the tool, the length of the working stroke being materially increased. In the drawing the flywheights are shown at A, the gearing at B, and the motor at C. D is the striking tup and E the tool. The two shafts F and G telescope to accommodate the stroke of the tup.—*June 26th*, 1924.

## MISCELLANEOUS.

217,427. June 26th, 1923.—Steam Traps, E. Eisenbeiss, Perlen, Switzerland.

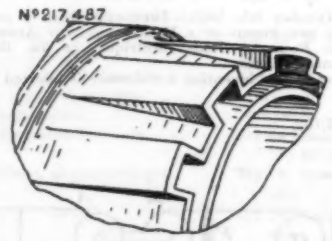
This steam trap is of the tilting bucket type. The inlet branch A delivers the water of condensation into a pivoted bucket B, which, when empty, assumes the position shown in the drawing. When the bucket fills, it tilts over to the right, and the water is blown out, by the steam pressure, *viâ* the pipe C and hollow




trunnion D. When the bucket is tilted the port E in the end of the trunnion coincides with a port in the casing, while the valve F is also opened. There is then a free passage for the water to the drain G. Any water which may collect in the casing is bailed out, at each tilting of the bucket, by the dipper H. A throttle J checks the inflow, whilst the bucket is tilted, while a counter K shows the number of buckets full which have been discharged.—*June 19th*, 1924.

217,487. October 10th, 1923.—Ejectors, J. Mulder, 81, Prinses Julianalaan, Rotterdam, Holland, and D. C. Endert, jun., 276, Mathenesserlaan, Rotterdam.

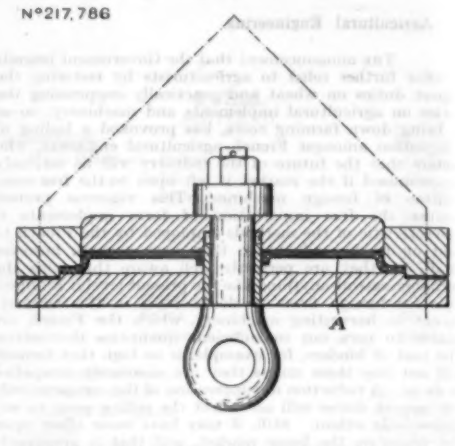
This invention is intended to overcome the difficulty experienced with large ejectors of keeping the several parts of the nozzles concentric. The outer and the inner walls of the annular nozzle, which are independent, run concentrically for a considerable distance up to the point of smallest cross section. The annular space between the walls is then divided into a circle




of channels by radial ribs extending in an axial direction. Hence, a reliable centring of the nozzle walls is obtained. The outer nozzle wall or the inner one or both on that portion of the annular nozzle, which widens towards the orifice, can be provided with grooves extending in an axial direction. These grooves give to the jet issuing from the nozzle an undulated surface; consequently, a large contact surface is provided between the effective medium and the medium to be delivered. The drawing represents a portion of the jet orifice.—*June 19th*, 1924.

217,786. July 19th, 1923.—Hydraulic Weighing Machines, A. E. Williams, Dagenham Dock, Essex.

This weighing machine is intended for hanging from a crane hook and is of the type in which a piston carrying the load is supported by fluid in a chamber connected with a pressure gauge. The special feature is the arrangement of the rubber diaphragm A in such a manner as to prevent leakage without causing undue friction. The stem of the piston, it will be seen, passes through




a central tube and the rubber diaphragm is curled up round this tube so that the internal pressure tends to keep the joint tight.—*June 26th*, 1924.

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

The Anglo-Galvanising Company, Limited, of Abbey House, Victoria-street, London, S.W. 1, has transferred its London works from Brentford to larger premises at Imperial Works, St. Mary's-road, Plaistow, E.

A. Fleming Browne, M.I. Mech. E., M.I.H.V.E., asks us to notify his change of address from 33, King-street, Covent Garden, W.C. 2, to 11, Carteret-street, Queen Anne's Gate, London, S.W. 1. Telephone, Victoria 6529.

W. Sisson and Co., Limited, of Gloucester, ask us to state that they have appointed, as their London representative, Mr. A. Fleming Browne, M.I. Mech. E., M.I.H.V.E., of 11, Carteret-street, Queen Anne's Gate, London, S.W. 1.

Holden and Brooke, Limited, of Sirius Works, West Gorton, Manchester, inform us that as from to-day they are giving up their agency arrangements in London, and are opening their own London office at 315, Abbey House, Westminster, S.W. 1, which will be under the management of Mr. W. Richard.

Automatic and Electric Furnaces, Limited, of Elecfurn Works, 173–175, Farringdon-road, London, E.C. 1, asks us to state that its works will be closing down from August 2nd to 10th inclusive, but that its demonstration rooms and offices will remain open, with the exception of Bank Holiday, August 4th.

Cole, Marchent and Morley, Limited, of Prospect Works, Bradford, Yorks., ask us to announce that their works will be closed from 5 p.m. on Friday, August 15th, to 8.30 a.m. on Monday, August 25th. A small staff will be kept in attendance for urgent matters, but no goods can be received or despatched during the above period.

## CONTRACTS.

The Avamore Pump Company, Limited, Sicklemill Works, Haslemere, Surrey, is now supplying its "Squeegee" pump to the Admiralty. It has also supplied a pump to the Board of Royal Engineers for pumping water for field purposes.

The Anglo-Galvanizing Company, Limited, of Abbey House, Victoria-street, Westminster, has entered into an agreement with the Expanded Metal Company, Limited, of West Hartlepool, to erect plant in the latter's works for working under licence the Anglo process of electro cold galvanising.

Goodwin, Barsby and Co., Limited, St. Margaret's Ironworks, Leicester, inform us that they have orders in hand for the Wigtownshire and Kirkcudbrightshire County Councils for Acme granulators, and a further order from the Limerick County Council for a special portable stonebreaker with a portable lifting screen.

Joseph Kaye and Sons, Limited, of Lock Works, Leeds, inform us that the Great Northern section of the London and North-Eastern Railway has recently accepted their tender for the supply for the next twelve months of railway carriage door locks with safety catches and handles. The same firm has also just received orders to supply 4292 similar locks to be fitted to the whole of the twenty-nine trains, consisting of 290 carriages, now being built for the Great Eastern section of that railway company, and continues to receive similar orders from all sections of the London, Midland and Scottish Railway.

A Century of Glass Making.—We have received from Chance Brothers and Co., Limited, a volume which they have just issued in celebration of their centenary. From it we learn that on May 18th, 1824, Robert Lucas Chance bought the property of the British Crown-Glass Company at Smethwick and so laid the foundations of the firm. It is of interest to note that three of the present directors are direct descendants of R. L. Chance or of his brother William. One of the first important achievements of the original partners was the manufacture in 1832 of sheet glass in England. Georges Bontemps, the famous French glass manufacturer, helped them in that enterprise, and a few years later instructed the firm in the manufacture of optical glass. From that date, 1848, up till the war of 1914 Chance Brothers were the only makers of optical glass in England, which is not surprising, seeing that even their trade had dwindled to nothing in the face of subsidised German competition. How the firm met the occasion when the need arose and supplied this country with the optical glass it needed for instruments of war is now a chapter of history. In 1851 the Lighthouse Works were established, and in 1872 Dr. John Hopkinson took over the management of them, and two years later introduced group-flashing. A fact upon which the firm properly prides itself is that from the very first it has maintained close and friendly relations with its employees—even as long ago as 1845 it erected and equipped schools for the children of its workpeople, and it has continued its interest in the welfare and education of its employees ever since. Many interesting illustrations will be found in this centenary volume.